Firm Moral Hazard in Short-Time Work

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Abstract

Short-time work (STW) programs held a central stage in the policy response to the pandemic in Europe, subsidizing temporary reduction in hours worked. While there is a growing literature on their employment effects, it has remained silent on moral hazard. Yet, its rapid expansion and large upscaling likely fueled moral hazard. This papers intends to quantify behavioral responses to STW in the context of France during the pandemic. Using exhaustive establishment-level and worker-level data on STW take-up and quasi-experimental variations in employer contribution to the program, I study two types of behavioral responses (i) misreporting and (ii) changes in real economic behavior. I estimate a bunching response to a discontinuity in cost along the wage distribution which stems from a reporting margin only. Using a variation in employer contribution across industries, I quantify a misreporting response as well as real adjustments of labor demand.

Keywords: Short-time work, policy design, firm behavior

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As a response to the COVID pandemic, policy makers across the globe aggressively extended their policy toolkit. The European Union responded swiftly by announcing an envelope of €100 billion of financial assistance to EU countries to develop or extend their short-time work (STW) or related schemes — making STW the main instrument to mitigate the labor market consequences of the pandemic. STW programs — also known as short-time compensation, work-sharing or shared-work programs — subsidize temporary reduction in labor demand on the intensive margin. When faced with a negative shock, a firm can temporarily reduce the number of hours worked by its employee. The employer pays for the hours worked while STW compensates the hours not worked — i.e. the hours furloughed.

Figure 1 shows the evolution STW take-up for a set of European countries. Panel A focuses on the COVID pandemic. In April 2020, STW take-up spiked to more than 20% of the working-age population in France and in the UK (where the program was created from scratch) and to more than 10% in Germany and Italy. It remained consistently high in 2020 and 2021. This was the consequence of (i) the magnitude and pervasive nature of the shock, but also of (ii) the unequivocal policy choice of European countries to focus on preserving job matches through STW rather than insuring workers against the cost of job loss through unemployment insurance.

Panel B zooms out in time to put these numbers into perspective with those of the Great Recession. While France, Italy, and Germany had operating STW schemes during the Great Recession, STW take-up was nowhere near the levels of the pandemic, reaching at most 5 percent of the working-age population. The pandemic marked an era of rapid and unprecedented take-up. To accommodate for higher demand for STW, European countries had to scale up their programs in an emergency.

While we know from empirical evidence from the Great Recession that STW is efficient at preserving jobs, we still know very little about how the design of the program affects employer behavior. Employers may have an incentive to rely excessively on subsidized hours reductions as they do not fully internalize the cost of the program — a problem called moral hazard. In the standard public finance framework, this means that we know close to nothing on the fiscal externalities associated with the program. This paper intends to remedy this gap by addressing the following questions: (i) what is the extent of moral hazard? *i.e.* how do changes in economic incentives affect employers' behavior? (ii) is there selection into moral hazard? *i.e.* what are the characteristics of firms that adjust their behavior? Given that STW is likely to remain part of the policy toolkit in Europe, and that it spurred interest in countries with no such program, these questions need to be addressed.

This paper studies STW in the context of France during the pandemic. First, it offers an ideal framework to study policy expansion in a recession. France had an existing operating STW scheme although, historically, take-up was very low. Prior to the pandemic, the program never covered more than 3% of the working age population while it spiked to over 20% of the working age population in April 2020.

Second, the design offers quasi-experimental sources of variation in employer contribution to the program. There are discontinuities in employer contribution to STW across workers — depending on their gross hourly wage —, over time — as some proportional employer contribution is phased in — and across industries — as the schedule of the latter differ by industry code. These discontinuities can be leveraged to identify behavioral responses to the cost of the program.

Third, the paper relies on extraordinarily granular and in-time data. Exhaustive administrative data on STW is available both at the worker and at the employer level. For each worker, there is monthly, if not sometimes weekly, information on hours furloughed and government compensation. For each establishment, there is information on the entire application process — from initial claims to actual compensations. Finally, information on STW take-up can be matched with exhaustive employer-employee data as well as establishment-level data. Information is timely and covers the entire pandemic up to June 2022.

STW is prone to behavioral responses of two sorts (i) misreporting and (ii) real economic responses. The latter correspond to adjustments of actual economic decisions of the employer — *e.g.* its labor demand or its demand for STW — while the former stems from a pure reporting margin.[1]

This paper leverages two quasi-experimental variations in employer contribution to the scheme to estimate behavioral responses to the cost of the program. The first one is a discontinuity across workers — depending on their gross hourly wage — while the second one is a variation across industries — depending on the establishment's industry code.

The first set of empirical evidence relies on a discontinuity in the cost of the program across workers, depending on their gross hourly wage, for the year 2020. While worker's hourly compensation is uncapped, government hourly contribution is capped. Below the cap, the bill is split proportionally between the government and the employer. Above the cap, the employer bears all additional cost of STW compensation to match worker's replacement rate. Upon claiming STW, the employer is responsible for reporting its

[1]In order to ensure expediency, the French government gave a lot of flexibility to employers to report information upon claiming STW — on their workers' hourly earnings and weekly hours worked, and on the generosity regime they were eligible to. The premise was that ex-post this information could and would be cross-checked by the public administration to prevent fraud.

employees' hourly wage. Theoretically, one could expect two types of responses to the existence of the cap (i) a substitution of labor demand across workers — as the cap reduces the relative marginal cost of work with respect to furlough for workers above the cap but not for workers below — and (ii) a bunching response in reported earnings. I have a unique framework in which true (counterfactual) information on earnings is available in administrative records and not manipulable. I estimate a large bunching response: there is a large mass of workers with reported hourly earnings exactly at the cap. Interestingly, this is entirely driven by a reporting response as the distribution of true hourly earnings for these workers is totally smooth. I go a step further and leverage the granularity of the data. For each worker, I have both reported information and the actual hourly wage. This allows me to locate workers reported at the kink in the actual wage distribution. I find that workers reported at the kink come from above the kink and that bunching is not local — suggesting a (perceived) cost of evasion non-convex in the size of evasion.

Then, I exploit a policy change which increased employer contribution to the scheme in some industries but not others. In June 2020, the government issued a categorization of industries into protected industries — *secteurs protégés* — and non-protected industries — *secteurs non-protégés* — defined at the industry level.[2] I leverage the introduction of some employer contribution in non-protected industries but not in protected industries to estimate two types of responses (i) reporting responses (ii) real economic responses.[3]

Upon claiming STW, employers self-report the regime they belong to which then determines their contribution to the scheme. Comparing assignment to treatment — based on establishment industry code — to actual treatment — based on reported information, I document that employers in non-protected industries claim disproportionately more under a more generous program than they are eligible to. They misreport 3.5 times more their hours than employers in protected industries, translating into an excess spending by the government of €45 million over just five months.[4]

I then focus on real economic responses. I use an event study approach to estimate the demand response to an increase in cost of the program for the employer. I complement it via an instrumental variable approach where I instrument actual treatment by assignment to treatment. Using a matching strategy, I estimate a decrease in the demand for the program by 22% (resp. 30%) in terms of workers (resp. hours) furloughed following an increase in employer contribution from 0 to 10% of worker gross hourly wage.

In conclusion, short-time work is prone to behavioral responses. Extending the policy as

[2]Protected industries are industries most affected by the pandemic — directly or through their trade partners.

[3]From June 2020, employers in non-protected industries proportionally contribute to STW by 10% of the worker hourly wage while employers in protected industries still face no proportional contribution to the scheme.

[4]This is estimated for the period of June to October 2020, a snapshot of total excess spending.

a reaction to the COVID shock opened the room for manipulation of reported outcomes. I estimate a bunching response to a discontinuity in the cost of the program driven solely by misreporting. I find reporting responses and a substantial decrease in the demand for the program following a small increase in employer contribution to the program.

While there is a growing literature on the employment effects of STW, it has remained silent on moral hazard. We know that STW is efficient at saving jobs and that its effects are heterogeneous (Giupponi and Landais [2020], Tilly and Niedermayer [2016], Cahuc et al. [2021], Meyer et al. [2017]). However, we know very little on how the design of the program affects employers behavior, the fiscal externalities, and hence how to calibrate it optimally (Giupponi et al. [2022]). This paper is the first to document extensively behavioral responses to STW design.

The existing evidence on STW comes almost exclusively from the Great Recession when STW programs were still in their infancy. This papier studies STW at a different episode, with higher take-up, and following an ad-hoc extension. Papers early into the pandemic have relied on calibrated models (Albertini et al. [2022], Birinci et al. [2020]), cross-country comparisons (Giupponi et al. [2022], Lafuente and Ruland [2022]) or survey data (Bennedsen et al. [2020]) to contribute in real-time to the policy debate. This paper is the first to cover the pandemic relying on exhaustive administrative data at the worker and establishment level.

STW schemes also sparked curiosity on the other side of the pond. During the pandemic, the US developed an alternative employment preservation scheme called the Paycheck Protection Program (PPP). Employers could apply for a loan under the PPP which would then be forgiven upon keeping their workers on payroll. This financial intermediation can affect access to the program (Chetty et al. [2020], Autor et al. [2020], Granja et al. [2020], Griffin et al. [2022]). There is a strong interest to understand how STW programs fared — in terms of targeting, effects, and distorsions — compared to that of the PPP.

Lastly, this paper contributes to the literature on reporting and tax evasion. The seminal bunching literature relies on functional form assumptions about the underlying counterfactual distribution to estimate bunching responses (Saez [2010]). Recent trends in the evasion literature try to find credible counterfactuals to avoid relying on such assumptions. Garbinti et al. [2023] study the effect of reducing reporting requirements on the composition of wealth below a certain threshold in the context of the French wealth tax. They compare reported wealth around this threshold before and after the policy change and estimate a bunching elasticity. Fan et al. [2022] study reporting behavior in the context of taxation on property transaction in Shanghai. They back tax-payer reported information by third-party reporting by the broker to document reporting patterns. In this paper, not only do I have the actual (counterfactual) distribution of earnings — which allows me to quantify the magnitude of the bunching response without any assumption — but I can also delve deeper into firm reporting behavior. For each worker, I can compare reported information upon claiming STW with actual information in employment data. I can disentangle perfectly reporting behavior from real economic adjustment.

The remainder of the paper goes as follows. Section 1 offers a description of the institutional background and of the data. Section 2 covers the discontinuity in employer contribution depending worker's gross hourly wage. Section 3 studies employer behavioral responses to a change in cost of the program across industries. Section 4 concludes.

1 Institutional Background and Data

1.1 The French *Activité Partielle*

Short-time work is an old program in France although take-up has been historically low. There was a growing interest for the program during and after the Great Recession, yet take-up never reached more than 3% of the working age population.[5] The pandemic brought the program to a new level. Figure 2 shows the number of workers furloughed over the course of the pandemic at a monthly frequency. While in January and February 2020 very few people were covered by the program, STW take-up covered nearly 6 million workers in March 2020. It remained consistently high during the first lockdown and stabilized at between 1 and 2 million workers until the Spring of 2021.

Eligibility and coverage At the onset of the pandemic, STW coverage was largely expanded to more workers and employers. While pre-pandemic, the program covered workers on open-ended contracts, fixed-term contracts, temporary workers, and part-time workers. It was further enlarged to workers with non-conventional hours arrangements. There is no restriction on tenure, even new hires are eligible.[6] On the employer side, STW is available to all firms with no restriction on the magnitude of the shock. The scheme was further extended to particular-employers. The lifting of all eligibility conditions reduced uncertainty for employers on their ability to benefit from the program.

The application process was highly simplified. While pre-pandemic, employers had to justify the need to furlough their workers, during the pandemic, they could simply invoke

[5] See Panel B of Figure 1 for a long run perspective on STW take-up in France.

[6] As a matter of fact, during periods of high seasonal recrutement — e.g. summer with art festivals and agricultural harvest or winter with the ski season -, the government encouraged establishments to hire seasonal workers as they normally would and then place them on furlough.

the pandemic as a *force majeure*. To ensure expediency, an absence of response by the public administration after 2 days was considered as tacit agreement, down from 15 days pre-pandemic. It was then reverted back to 15 days in October 2020. Additionally, employers could claim retroactively within 30 days. Take-up of the program was not associated with an employment preservation clause.[7] The maximum duration of coverage was extended successively from 6 to 12 months and later to 24 months, covering the entire duration of the pandemic.[8]

Generosity The program was also made more generous to workers and less costly to employers. Worker hourly compensation went from 60% to 70% of her gross hourly wage. Employer went from bearing most of the cost of the program to no cost. Government contribution to STW was uniform across sectors at the onset of the pandemic. In June 2020, a proportional employer contribution to the scheme was introduced in some establishments based on their industry code. This corresponded to 10% of worker gross hourly wage and amounted to 14% of the worker compensation. Establishments in industries most affected by the pandemic still faced no proportional contribution to the program. Figure B3 describes the evolution of employer proportional contribution to the scheme over time across industries.

Individualisation A key feature of the French STW scheme is individualisation. Employers can choose who to furlough and with which intensity. There is no restriction on the number of hours nor on number of workers furloughed within the firm. This is the most flexible form of design. As a comparison, in the UK, hours reduction was initially constrained at 100%, meaning that workers were either fully furloughed or fully working.

Worker Compensation Worker hourly STW compensation corresponds to 70% of her gross hourly wage (roughly 84% of her net hourly wage), with a floor and no cap in 2020. Figure 3 describes the relationship between a worker gross hourly wage and her hourly STW compensation in 2020. In 2021, a cap was introduced in worker hourly compensation at 4.5 minimum wage (MW).[9] Beyond that cap, a worker is compensated at 70% of 4.5 MW regardless of her hourly wage, translating into a decreasing replacement rate. Furthermore, worker hourly compensation decreased to 60% of her gross hourly wage in September 2021.[10]

[7] Later into the pandemic, an alternative program was developed called long term short-time work — *activité partielle de longue durée*. It was targeted at establishments affected more permanently by the pandemic and comprised an employment preservation clause.

[8] For a cross-country comparison of the evolution of STW schemes in Europe see Corti et al. [2023].

[9] This cap is set at the exact same value as the cap for government contribution in 2020.

[10] This holds for all workers except those in an establishment subject to administrative closure. The latter experience a decrease in STW compensation in April 2022.

With respect to its European counterparts, the statutory replacement rate is close to the average replacement rate. However, differences in the floor and cap to worker compensation are large across countries. France is pretty unique in the fact that workers at the minimum wage do not incur any income loss. The effective replacement rate of low income workers is higher than that in other European countries. On the other end of the income distribution, France is one of the countries with the highest cap as a fraction of median income. The cap, set at 4.5 MW, corresponds to 262% of the median income compared to 200% in Sweden or 100% in Spain. This means that the actual replacement rate of high income workers is also higher in France.

Employer Contribution The most significant change in the program is probably the extent of government contribution to the program. While pre-pandemic the employer bore most of the cost of the program, at the onset of the pandemic, there is little to no employer contribution. The government played a critical role in insurance provision. Figure 4 illustrates the decomposition of costs between the government and the employer.

Figure 4A illustrates the schedule in use at the core of the pandemic, up to June 2020 in all industries, and going forward in some industries until 2021. The worker gets 70% of her gross hourly income in STW compensation (as per the purple line). The government (in blue) covers all STW compensation up to a cap. At the cap, set at 4.5 MW, the employer (in orange) takes-over and tops-up government contribution to reach worker's 70% replacement rate.

In June 2020, the government established a list of industries most affected by the pandemic — called *protected* industries. These corresponded to industries most affected by the pandemic either directly (S1) or through their trade partners (S1 bis). This classification affects employer contribution to STW and later (in 2021) employee compensation. While establishments in protected industries were covered by the regime described above for the whole of 2020, establishments in non-protected industries faced a different schedule from June 2020.[11]

Figure 4B illustrates the schedule introduced in June 2020 for establishments in *non-protected* industries. Below the cap, the employer now faces a proportional contribution to the scheme by 10% of worker gross hourly wage with the government covering the remaining 60%. Similarly to the other schedule, above the cap, the employer bears all additional cost of STW.

Interestingly, the design of STW is such that the employer contributes to the program based on contemporaneous usage. In that sense, it differs from standard experience rating where current contribution depends on past usage of the program. Here, regardless of

[11] There is a third, smaller, category which corresponds to establishments subject to administrative closure which I exclude from my analysis.

the number of hours furloughed and the number of workers furloughed, all employers contribute the same per hour furloughed.

Financing During the pandemic, most of the cost of the program is borne by the state. In terms of public funding, the costs are covered by 67% by the State budget and by 33% by the French Public Unemployment Insurance agency (*Unédic*). STW compensation also yields lower social security contribution. STW compensation is considered a replacement income and not an income from employment. The employer is exempt from social security contributions on STW contribution.[12] On the worker side, the replacement income is subject to some social security contributions but at a lower rate. [13] This affects public finances through the levy of less social security contributions.

Between March 2020 and June 2022, STW compensations are estimated at € 35 billion. This is the consequence of a number of factors — more generous compensation, larger government contribution, extended coverage, simplified access, and the magnitude of the shock.

Claiming Short-Time Work A particularity of STW compared to UI is that the procedure is initiated by the employer. The employer is in charge of applying for and claiming STW and receives government transfer. The claiming process comprises different stages. First, the employer sets up an establishment profile and a worker profile for each employee covered by STW. Then, the employer submits a prior authorization request describing the intended coverage: date, number of employees, and hours furloughed. The employer receives a notification from the public administration. Upon approval, for each month covered by the agreement, the employer can claim STW. For each employee covered by the agreement, the employer reports her weekly hours worked. This determines the number hours furloughed and the size of the government transfer. Then, the employer compensates its workers for the hours furloughed — a combination of government transfer and of its own contribution. All procedures are centralized through an online platform, most steps of the process have been made available for research.

The claiming process relies heavily on employer's reporting. Indeed, employers manually fill in their workers' characteristics including their gross hourly wage. The latter determines both worker compensation and employer contribution. Once a differentiation in employer contribution is introduced across industries, employers have to self-report which generosity

[12]This also applies to any voluntary transfer from the employer beyond the legal requirement — to meet a 100% replacement rate for example.

[13]The CSG (generalized social contribution) and the CRDS (contribution to the repayment of social debt) are levied on income from employment and on replacement income (unemployment benefits, retirement pensions, etc.). The rate of contribution to CSG is 6.2% on replacement income against 9.2% for income from employment.

regime they are eligible to. This determines the level of employer proportional contribution to the scheme.

1.2 Data

1.2.1 Short-Time Work Data

I use the entire universe of administrative records of STW claims and compensation. Data covers the entire process from the initial application, to government decision, to STW claims and subsequent compensations. Information is available both at the establishment and at the worker level.

Employer-Level Data For each establishment, I have access to its profile on the platform. I have information on the establishment identifier and some establishment characteristics. Some information is pre-filled, such as the location of the establishment, some is self-reported, such as their industry code.[14]

I also have data on STW applications, claims, and compensations. There is a record of every procedure initiated through the portal. The content of the application is described in the paragraph above. I also have information on STW claims.[15] In claims data, I can isolate information on the rate of government contribution to infer whether STW was claimed under the protected or non-protected regime.

Worker-Level Data In order to study STW take-up intensity, I leverage worker level data. For each worker, there is monthly information on the number of hours furloughed and the corresponding government transfer (in €). For most workers, information is also available at the weekly frequency.[16] Some demographic information on workers is available such as their gender, date and place of birth, and occupation.[17] These correspond to information reported by the employer upon setting up the worker profile. Interestingly, worker gross hourly wage is reported by the employer. This piece of information is crucial to determine worker compensation and employer contribution.

[14] Information on location was used to assign claims to the corresponding local authority. I use this information to assess the ability of the public administration to pre-fill information in an emergency.

[15] For each claim, there can be various iterations. The sample is restricted to the last iteration according to which the compensation goes through.

[16] Weekly level information is available for workers for which working hours can be decomposed at the weekly frequency — e.g. standard employment contracts. See Appendix D.3.1 for a comparison of the weekly sample to the entire sample.

[17] Occupation categories are specific to the platform and do not match the French occupation classification (PCS-ESE). There are 12 different categories. Some are fairly standard such as managers, but most of them are highly specific — e.g. apprentices, freelance workers. The latter were used by the public administration to classify the type of working time arrangements the worker was under.

1.2.2 Other Administrative Sources

Employment data I use exhaustive employer-employee data for 2020. The data allows to track workers over two consecutive years. Information on 2019 employment allows for a pre-pandemic baseline. Employment data for 2020 covers the pandemic period. There is information both on work and furlough at the yearly frequency. For each worker, there is information on the total number of hours worked and furloughed as well as on earnings from work and STW compensation. The latter corresponds to the sum of government and employer contribution. It is pretty straightforward to match information on STW and employment at the establishment level using the establishment identifier. However, there is at the time of writing no common worker identifier to map workers across STW and employment data. In some empirical exercises, I nonetheless rely on a matched sample. I use exact matching on the establishment identifier of the employer, on the worker gender and place of birth and Mahalanobis distance on worker's age and on the total number of hours furloughed in 2020.[18] I specifically do not match on reported hourly wage as it is subject to misreporting nor on total compensation as in the employment data it comprises both government and employer contribution while in STW data is only corresponds to government contribution.

Establishment-level data I use information on the universe of existing establishments at the end of 2019 and of 2020. This data takes stock of the universe of operating establishments as of Dec 31st of a given year. It contains information establishment characteristics — e.g. location, industry code, and total employment. The sample corresponds to establishments with a real economic activity in the tradable non-agricultural industry, construction, trade, and service sectors.

2 Discontinuity in Cost Across Workers

In this section, I leverage a discontinuity — a kink — in employer hourly contribution to STW depending on its worker's gross hourly wage and estimate its effect on employer furlough decision. Importantly, worker's gross hourly wage is reported by the employer upon claiming STW. I derive a conceptual framework to illustrate how the kinked schedule affects the employer labor demand — trading off hours worked and hours furloughed — in a framework with and without reporting. Empirically, I have a unique setting in which reported earnings can be put into perspective with counterfactual administratif records. I estimate two types of behavioral responses (i) a real economic response, *i.e.* a change in the relative labor demand across workers and (ii) a reporting response.

[18]In some empirical exercise I further restrict the sample to workers for which total hours furloughed and age are within a range of one unit.

2.1 Setting

Figure 4 illustrates the schedule of employer and government hourly contribution to the scheme in 2020. For each level of gross hourly wage (x-axis), it shows a decomposition of the worker's hourly compensation — marked by the purple line — into government (in blue) and employer (in orange) contribution as a fraction of worker's gross hourly wage (y-axis). Panel A of Figure 4 corresponds to the schedule prevalent at the core of the pandemic, from March to June 2020, for all establishments and onwards for establishments in protected industries. Panel B of Figure 4 corresponds to the schedule faced by establishments in non-protected industries from June 2020.[19]

In both schedules, for each hour furloughed, a worker gets 70% of her gross hourly wage subject to a floor but no cap.[20] There is a discontinuity in employer contribution to the scheme at 4.5 minimum wage — henceforth the cap — marked by the red vertical line. Below the cap, the employer and the government contribute proportionally to STW compensation. In Panel A of Figure 4, employer proportional contribution is null while in Panel B, it corresponds to 10% of the worker's gross hourly wage. At the cap, government contribution is maximal — this maximal amount is indicated by the red dashed vertical line. Above the cap, government contribution remains constant and the employer bears all additional cost of STW to meet worker's 70% replacement rate. In Panel A of Figure 4, this corresponds to the entire orange area while in Panel B this corresponds to the orange area between the purple line (worker's replacement rate) and the white dashed line (which isolates the employer contribution that corresponds to the proportional contribution). In both cases, at the kink there is a discontinuity in employer hourly contribution to STW.

2.2 Conceptual Framework

Let us consider a simple theoretical framework to illustrate firm's labor adjustment to a shock. The goal is to derive theoretical predictions of how the kink in employer contribution to STW affects its furlough decision. First, I consider a setting with no opportunity to (mis)report worker's gross hourly wage. Second, I incorporate a reporting margin on worker's gross hourly wage — as per the French design — and study how it distorts the initial trade-off.

[19] For more details on the categorization of protected and non-protected industries, see Section 1.

[20] Workers at the minimum wage get a replacement rate of 100% — the floor. There is then a range of hourly wage between the floor and when the floor corresponds to 70% of the worker's gross hourly wage, where worker's replacement rate is above 70%.

2.2.1 A Model With No Reporting of Hourly Wage

I start from a standard model of firm labor demand — a cost minimization program under a production constraint. I consider a setting with two workers, one with hourly earnings above the cap and one with hourly earnings below the cap. Workers are assumed complementary in the production function. I start from a pre-pandemic equilibrium and introduce a shock to the demand the firm faces. I consider successively how the firm adjusts its labor demand to the shock — trading off hours worked and hours furloughed — under a linear STW schedule and then under a kinked STW schedule. I define a linear schedule by a schedule in which the employer contributes to STW by an amount proportional to STW compensation and a kinked schedule by a schedule with both a proportional contribution and a linear contribution beyond a certain value. This subsection abstracts from any reporting margin.

The core of the text presents the intuitions behind the different predictions, using as supporting material a graphical illustration. The formal derivations are available in Appendix C.2.

Let us consider two types of workers: a low type — indexed by L — with gross hourly wage ω_L below the cap $\bar{\omega}$ and a high type — indexed by H — with gross hourly wage ω_H above the cap. For each hour furloughed, the worker receives $\tau * \omega$ of STW compensation with τ the replacement rate — i.e. the fraction of earnings loss covered by STW. Under the linear schedule, the employer contributes proportionally — by a fraction ρ — to STW compensation. The employer pays $\rho * \tau * \omega$ per hour furloughed. Under the kinked schedule, the employer contributes proportionally and additionally tops up above the cap: $\rho * \tau * \omega + (1 - \rho) * \tau * min(\omega - \bar{\omega}, 0)$.

Figure C4 provides a graphical illustration of the different equilibria. The x-axis corresponds to the labor demand for the low type (l_L) and the y-axis to the labor demand for the high type (l_H). The convex curves corresponds to isoquants, combinations of labor demand that yield similar levels of production. The highest isoquant (north east quadrant) corresponds to labor bundles that allow to produce the pre-pandemic output ($\bar{y}$). The lower isoquant allows to produce the pandemic output ($\tilde{y}$). The iso-cost curves are represented by the downward slopping lines. They correspond to combinations of labor demand that add up to a similar cost for the employer. Their slope slope is equal to minus the ratio of marginal cost of an hour of work between the high and the low type.

The initial equilibrium (A) is the tangency point between the isoquant corresponding to the initial demand ($\bar{y}$) and the iso-cost curve with slope equal to the ratio of gross hourly wages ($-\omega_H/\omega_L$). The shock to the demand is characterized by a lower isoquant ($\tilde{y}$). The iso-cost curves under the linear STW schedule have a similar slope to before — as under the linear schedule, the marginal cost of each type of labor is affected proportionally and therefore the ratio simplifies. The iso-cost curves under the kinked STW schedule have a lower slope in absolue value $(-(1-\rho*\tau)*\omega_H/\omega_L)$ as illustrated by the dashed line. This is due to a decrease in the marginal cost of an hour work for the high type, due to the opportunity cost of furlough. Moving from a linear to a kinked schedule shifts the equilibrium from B to C. There is a substitution of hours worked by the low type for hours worked by the high type.

In conclusion, compared to a linear schedule, the kinked schedule should distort employer labor demand towards the high type. Indeed, it reduces the marginal cost of labor for the high type — as the employer saves on STW contributions — but not that of the low type. [21]

Before moving to an estimation of this real economic response to the kinked schedule, the next sub-section provides ingredients for a model of labor demand across workers under a kinked schedule and with the possibility to report the worker's gross hourly wage.

However, the actual STW design allows for a reporting margin. Upon claiming STW, the employer manually reports the worker hourly wage allowing for a wedge between actual wage ω_i and reported wage $\hat{\omega}_i$.

2.2.2 A Model With Reporting of Hourly Wage (in progress)

One needs to incorporate an additional choice variable in the employer program — reported wage — denoted $\hat{\omega}_i$. The employer can chose to misreport the worker's gross hourly wage and report a wage $\hat{\omega} \neq \omega$. Misreporting entails a cost C(.) on whose structure I remain agnostic for now. There is a trade-off between reducing the tax liability — i.e. reducing hourly contribution to STW by reporting $\hat{\omega} < \omega$ — and the cost of evasion — encapsulated by the C(.) function. The cost of evasion depends on the perceived probability of audit and the magnitude of the sanctions.

2.3 Method and Estimation

2.3.1 Method

I leverage various empirical exercises — at the worker and at the population level — to document the extent and type of behavioral responses to the discontinuity in employer contribution to STW.

The main empirical exercise compares the density of reported wage to the density of observed wage among the population of short-time work takers in 2020. More specifically,

[21]For simplicity, this toy model considers only interior solution (i.e. demand for the two types of workers), ignores the impact of total cost on separation or production margin.

for the population of workers furloughed in 2020 and continuously employed in 2019 and 2020, one can put into perspective the distribution of reported gross hourly wage upon claiming to that of observed gross hourly wage in employment data pre-pandemic (2019) and during the pandemic (2020).

The density of gross hourly wage of STW takers as per employment data in 2019 is informative of whether there is indeed a differential take-up decision above and below the kink. Then, one can compare the density of gross hourly wage of STW takers as observed in the employment data in 2020 to that of 2019 to assess whether there is an adjustment of wages to incentives.

Finally, I can study the reporting margin by comparing the distribution of reported earnings upon claiming STW to actual earnings as per employment records. I have a unique setting in which counterfactual information on worker hourly wage is available and not manipulable. This is the ideal experiment in the reporting literature as it relies on no assumption about the counterfactual distribution of hourly wage. I can quantify the bunching response by comparing the number of workers reported at the kink to the actual number of workers with earnings at the kink.

To further study the reporting margin, I use information at the worker level. For each furloughed worker, I can pin down exactly what her actual gross hourly wage is from the employment data and put it into perspective with the reported wage. For each bin of 1€ of gross hourly wage, I retrieve the distribution of reported wage upon claiming. I plot the median reported hourly wage against actual hourly wage to inform the reporting pattern. Moreover, to document the bunching in reported earnings, I provide empirical evidence on the origin — in the true location in the wage distribution – of workers reported at the kink. This information can be used to characterize the cost of evasion.

2.3.2 Estimation

Main findings Figure 5 overlaps the densities of gross hourly wage as per administrative data for 2019 (in gray) and for 2020 (in blue) and the density of reported gross hourly wage as per STW data (in red). The sample is restricted to short-time work takers in 2020.[22] The cap in government contribution at 4.5 MW is marked by the red dashed vertical line. While the distribution of gross hourly wage as per employment data is smooth around the kink, there is a large mass of workers with reported earnings at the kink. Interestingly, this corresponds to a reporting response rather than a real behavioral response. Employers and employees do not adjust gross hourly earnings to be at the threshold (as illustrated by the blue distribution). However, employers misreport their

[22]The sample is restricted to workers which have used furlough for at least 20 hours in 2020 to avoid

employees' gross hourly wage and bunch where government contribution is maximal and just before where they would bear all additional cost of STW.

Real economic response The conceptual framework with no reporting suggests that a kinked schedule should, in theory, distort the relative demand for work in favor of workers above the kink. Figure 5 offers some insights into this. There is no discontinuity in the density of workers taking-up short-time work along the observed earnings distribution — be it in 2019 (in gray) or in 2020 (in blue). This suggests little to no substitution across workers.

Bunching response from misreporting From Figure 5, the reporting response is very striking. There is a large mass of workers reported at the discontinuity in employer contribution with no counterfactual in the observed wage distribution of these very same workers. This figure is also informative about the reporting behavior of firms. Indeed, the bunching comes from reported gross hourly wages exactly at the kink which suggests that the perceived probability of audit is not increasing at the kink.

Cost of evasion Appendix C.3.2 provides additional empirical evidence on the reporting behavior of firms and on this bunching response. The ability to link employees across data set is unique and allows to characterize the cost of evasion — C(.). Indeed, at the worker level, I can retrieve information on the distance of reported information to the true value — the size of evasion — as well as the actual location of workers reported at the kink.

Panel A of Figure C5 provides a first insight into the location in the wage distribution of workers reported at the kink. The x-axis corresponds to bins of 1€ of gross hourly wage as per the employment data. The y-axis corresponds to the count of workers reported at the kink in each wage bin. The red vertical line marks the discontinuity in the cost of the program. The first take-away from this graph is that most workers reported at the kink are to the right of the red vertical line, meaning that their true hourly wage lies above the kink and that employers should have topped-up worker compensation — i.e. had an incentive to misreport. The second take-away, and potentially the most striking one, is that the bunching is not local and persists for high values of hourly earnings.

Panel B of Figure C5 provides an alternative representation of the location of workers reported at the kink. While the x-axis still corresponds to bins of gross hourly wage as per employment data, the y-axis now corresponds to the share of STW takers reported at the kink among the all STW takers in this wage bin. This corresponds to a rescaling of Panel A by the size of each wage bin. The share of workers reported at the kink is an increasing function of the distance to the kink.

Standard models of evasion rely on the assumption of an increasing and convex cost of evasion. This generates a prediction of local bunching, via a segment where the cost of evasion is first dominated by the reduction in tax liability and then dominates the latter. Figure C5 does not support this assumption and rather suggests of a cost of evasion insensitive to the size of evasion.

Additional evidence will follow on the evolution of the evasion pattern over time with the evolution of the composition of STW takerswith the ability of public administrations to process claims , and with the size of evasion incentives — i.e. reduction in tax liability — depending on whether there is prior employer contribution below the kink or not.

2.3.3 Concluding Remarks

There is little to no distorsion in the decision of who to furlough around the kink. The main response is a reporting response with a bunching in reported earnings where government contribution is maximal and employer contribution minimal.

The bunching response is not local and workers reported at the kink have hourly earnings above the kink. Put together, these findings suggest that (i) the cost of misreporting is not convex in the distance to the true value — the perceived magnitude of the sanction or probability of audit is not sensitive to the size of evasion (ii) the (perceived) probability of audit does not increase exactly at the kink.

While this has no effect on government spending — holding the demand for the program constant — as the cap in government contribution is met, it affects worker's hourly STW compensation. Further research is needed to understand what makes this acceptable from the worker perspective.

3 Discontinuity in Cost Across Industries

3.1 Policy Design

Policy change This empirical exercise relies on a policy change occurring in June 2020. Prior to June 2020, employers did not contribute proportionally to STW compensation (see Panel A of Figure 4). June 1st 2020 marks the introduction of some proportional employer contribution by 10% of worker's gross hourly wage (see Panel B of Figure 4) for employers in non-protected industries. Establishments in protected industries, defined by a list established by the government, remained in the previous contribution schedule and did not face this increase in employer contribution.

Behavioral responses I study two types of behavioral responses to this price change. The first is a misreporting margin. Upon claiming STW, employers had to manually report the generosity regime they were eligible to. I use establishments' industry code to establish their assignment. I then compare their assignment to their effective treatment — the generosity regime they select into upon claiming. I document the extent to which establishments that had to face this proportional employer contribution misreport the regime they belong to thus avoiding the proportional contribution. The second margin is the adjustment of real economic behavior. I study how this price change affects the demand for the program. Using an event study method and a matching procedure, I compare the evolution of the demand for the program for establishments assigned to the non-protected schedule compared to establishments assigned to the protected schedule. The outcomes of interest are the number of firms claiming and the number of workers and hours claimed. I then move to an instrumental variable regression approach. I instrument the fact of bearing the proportional contribution to the program by assignment to this increased employer contribution. This allows to rescale the estimated effect by incorporating the misreporting margin.

3.2 Identification of Protected Status

Classification I manually retrieve information on assignment up to October 2020. I use the list of activities covered by the protected regime established by the government and map these activities into the French industry code classification (NAF). The mapping is mainly straightforward with a few exceptions.[23] I retrieve information on establishment industry code from the 2019 administrative registry of establishments. Then, based on the establishment industry code, I assign treatment based on the list of protected industries.

Descriptive statistics Table D1 offers some descriptive evidence on the characteristics of establishments with protected (resp. non-protected) industry codes as of 2019. Column 1 corresponds to the general population while columns 2 and 3 correspond to establishments respectively in protected and non-protected industries. Establishments in protected industries account for 17% (220,000) of all establishments. Compared to the general population, they are on average overrepresented in the service industry (99% of them compared to 77%). Establishments are on average slightly younger with 20% of them less one year old (against 14% in the general population) and 36% between 2 and 9 years old (against 30% in the general population). In terms of employment, there have an average of 9 workers compared to 14 for the general population. They have a higher

[23] I exclude from the sample industry codes which comprise both protected and non-protected activities. For example, model agency (resp. currency exchange offices) belong to a broader category of placement agencies (resp. brokers). This means that my results should not suffer from ambiguity in categorization.

proportion of workers in fixed-term contracts (15% against 11%) as well as less hours worked per employee.

3.3 Reporting Margin

3.3.1 Identification

Method The first margin of behavioral response to this increase in cost of the program is a reporting margin. I leverage the fact that upon claiming STW employers self-report the generosity regime they belong to. I retrieve manually information on assignment and compare assignment to actual treatment based on reported information.

Establishments in protected industries are eligible to the most generous schedule. Indeed, they do not face any proportional contribution. Employers in protected industries have no incentive to misreport the generosity regime they belong to, otherwise they contribute more than they should. As such, their errors can be considered as a baseline for random errors from reporting. On the contrary, establishments in non-protected industries have to, by assignment, contribute by 10% of the worker gross hourly wage. Upon claiming, they face the following trade-off (i) reporting the correct regime and facing the additional cost (ii) misreporting, with a probability of being caught, and avoiding this additional cost.

First, I count the number of establishments claiming under each regime by assignment. Then, I compute the share of establishments in each configuration — correctly report vs misreport — among establishments in protected (resp. non-protected) industries. Excess misreporting corresponds to the difference between the the share of establishments that misreport among establishments assigned to non-protected industries and the share of establishments that misreport among establishments assigned to protected industries.

I consider successively three outcomes: the number of establishments, the number of hours claimed, and total compensations. The latter two allow to reweigh misreporting by the intensity of STW usage.

3.3.2 Results

Share of misreported outcomes Figure 6 reports the share of firms and hours compensated under each regime by assignment. The first two columns correspond to the decomposition of the outcome for establishments in protected industries while the last two for establishments in non-protected industries.

Panel A of Figure 6 studies the reporting behavior at the extensive margin — *i.e.* at the establishment level. Over the period of interest, 87% of establishments in protected industries claim under the correct regime (column 1) while the remaining 13% (column 2) claim under a less generous regime then they are eligible to. These proportions vary significantly when looking at the reporting behavior of establishments in non-protected industries. Indeed, 73% of establishments in non-protected industries claim under the correct non-protected regime (column 3) while 27% of establishments claim under a more generous regime than they are eligible to (column 4). What happens then when we consider the intensive margin?

Panel B of Figure 6 performs a similar exercise looking this time at hours compensated. Establishments in protected industries claim 94% of their hours under the correct regime which is the protected regime (column 1). For 6% of hours, the claims fall under a less generous regime than what the employer is eligible to (column 2). When looking at establishments in non-protected industries, the repartition is much different. They only claim 79% of hours under the correct regime (column 3) and misreport 21% of hours in a regime more generous than they are eligible to (column 4).

This suggests that while a fair share (13%) of establishments in protected industries claim under a less generous regime then they are eligible to but they account for a much smaller share of total hours compensated (6%). They usually claim on average fewer hours than their counterpart that claim under the correct regime. This could stem from establishments not being very familiar with the program or claiming platform. We do not observe a similar pattern for establishments in non-protected industries. Misreported status accounts for 27% of establishments and 21% of hours furloughed. There are potentially further layers of heterogeneity in claiming pattern across establishments in non-protected industries that misreport their status. Figure D6 provides a similar graphical representation using as an outcome total STW compensations.

Misreporting ratio A natural step is to quantify the magnitude of the difference between the two types of incorrect claims. Figure 7 computes the ratio of the error from establishments in non-protected industries over that of establishments in protected industries. The underlying assumption here is that the error of establishments in protected industries — that works in their disfavor — is the baseline error rate. These errors could be due to inattention or confusion about the classification. Columns 1 and 2 correspond to the ratio of the two red columns of the previous figure (Figure 6). Establishments in non-protected industries misreport nearly four times more their hours than establishments in protected industries (.21/.6). Misreported amounts (column 3) are of the similar magnitude. The ratio of misreported status in terms of establishments (column 1) is however much lower, of around 2. This indicates that upon claiming, these establishments tend to claim more hours and higher compensations than establishments that misreport in protected industries. These ratio are consistent with estimates from the French Ministry of labor (DARES [2023]).

Quantification Table D2 provides the figures behind the proportions. When looking at total compensations, one can derive a measure of the excess spending of the due to misreporting. Over the period of study, June to October 2020, the government spent an excess €45 million in short-time work compensations which should have been born by employers.

This measure of excess spending is a holding constant the demand for STW. Absent the opportunity to misreport, it is possible that employers would adjust their demand for the program. That is, if they were to internalise some of the cost, they would potentially reduce their demand for the program which would in turn affect government spendings.

Heterogeneity Figure D7 provides a declination of the misreporting ratio of hours by establishment characteristics. The baseline level is 3.8 as per Figure 7. Establishments that misreport more tend to be younger, to have experienced more negative employment growth between 2015 and 2019, and have either very large workforce (more than 250 employees) or an intermediate one (10 to 49).

3.4 Real Economic Responses

3.4.1 Identification

Identification This discontinuity in employer contribution to the scheme creates a sharp difference in incentives for employers to use the program based on their industry code. I use this quasi-experimental variation in short-time work generosity to identify the demand response of establishments in terms of STW take-up. I consider the effect of an increase by 10 p.p. of employer contribution on the demand for STW looking both at extensive margin — the number of firms claiming — and the intensive margin — looking at the number of workers furloughed as well as the number of hours furloughed. The treatment group is composed of establishments in the non-protected sectors which face an increase in the cost of using STW. The control group is made of establishments which do not see an increase in the cost of using STW that is in protected sectors.

Conditional independence Protected sectors are industries most affected by the pandemic, directly or through their trade partners. In that sense, treatment assignment is partly endogenous. To circumvent this, I use a matching procedure to create a credible control group. I exclude from the donor pool establishments in the hospitality industry as they are subject to specific reopening rules. I restrict the sample to establishments that take-up STW in all five weeks prior to the event.[24] I use exact matching on the establishment location and size category and Mahalanobis distance on employment gender and contractual composition as of 2019 as well as weekly total employment, weekly hours and workers furloughed in the five weeks prior to the policy change. The identifying assumption is that absent the change in cost, the two groups' demand for the program would have evolved in the same way.

Reduced form estimation For each outcome Y, the baseline specification underlying the reduced form graphical evidence is:

$$
\begin{aligned}
Y_{i,s,t} = &\sum_j \beta_j \times \mathbb{1}\{s \in \mathcal{E}\} \times \mathbb{1}\{j = t\} \\
&+ \sum_j \gamma_1^j \times \mathbb{1}\{j = t\} + \gamma_2 \times \mathbb{1}\{s \in \mathcal{E}\} + \epsilon_{i,s,t}
\end{aligned}
\tag{1}
$$

with $Y_{i,s,t}$ the outcome Y for establishment i, belonging to industry code s, in week t. An establishment either belongs to the group of industry codes where employers contribute proportionally to STW ($s \in \mathcal{E}$) or to the group of industry codes that face no proportional contribution ($s \in \mathcal{E}^C$). The regression comprises both non-protected (γ_2) and week (γ_1^j) fixed effects to control for baseline differences across the two groups and common time effects.

The coefficients of interest are the β_j. They track the dynamics of the effect of the change in the cost of the program on the outcome of interest. They correspond to the relative evolution of the outcome of establishments in non-protected industries relative to that of establishments in protected industries over time. All coefficients are expressed relative to t-1 levels which corresponds to the last week of May.

IV estimation I complement the reduced form evidence with an instrumental variable approach where I instrument the probability of bearing the proportional contribution to STW, T, by the assignment to this proportional contribution. The instrument corresponds to an interaction term of being after June 1st, 2020 ($t > 2020w23$) and belonging to the set of industry codes which are non-protected ($s \in \mathcal{E}$). Specification (2) illustrates this instrumental variable approach with specification (3) the corresponding to the first stage:

[24] The policy change occurs on June 1st, four weeks after the end of the first lockdown on May 3rd. The sample thus focuses on establishments that take-up the program consistently in the four weeks following the end of the first lockdown.

$$
\begin{aligned}
Y_{i,s,t} = & \beta_{IV} \times T_{i,s,t} \\
& + \sum_j \eta_1^j \times \mathbb{1}\{j = t\} + \eta_2 \times \mathbb{1}\{s \in \mathcal{E}\} + \mu_{i,s,t}
\end{aligned} \tag{2}
$$

$$
\begin{aligned}
T_{i,s,t} = & \kappa_1 \times \mathbb{1}\{s \in \mathcal{E}\} \times \mathbb{1}\{t > 2020w23\} \\
& + \sum_j \kappa_2^j \times \mathbb{1}\{j = t\} + \kappa_3 \times \mathbb{1}\{s \in \mathcal{E}\} + \nu_{i,s,t}
\end{aligned} \tag{3}
$$

3.4.2 Main results

Each of the four panels of Figure 8 plots the coefficients β_j for all weeks from the last week of April (t=-5) till the second week of July (t=+5) from a regression following specification (1). The vertical dashed line between t=-4 and t=-3 corresponds to the end of the first lockdown in France. The policy change occurs three weeks later, on June 1st 2020, and is marked by the vertical solid line.

Panel A of Figure 8 uses as an outcome the probability to claim under the non-protected regime — that is the probability to face the increase in cost of the program. It confirms previous evidence from Figure 6, that being assigned to the non-protected regime is correlated with claiming under this less generous regime.[25] This corresponds to the variation used to identify the causal effect of the change in price on the demand for the program. The instrument accounts for a 50 percentage point increase in the probability of claiming under the non-protected regime, starting from a baseline of zero as this generosity regime did not exist prior to the policy change. This probability remains close to 50 percent in all subsequent weeks.

Panel B, C, and D of Figure 8 display estimates of the effect of employers facing a costlier scheme on the demand for STW in terms of the number of establishments claiming (Panel B), of log number of workers furloughed (Panel C), and log number of hours furloughed (Panel D). There is a sharp relative decrease in the number of firms claiming following the increase in the cost of the program. On the intensive margin, employers in non-protected establishments reduce the number of workers and hours furloughed following the introduction of proportional employer contribution. The estimated IV coefficients,

[25] In Figure 6, the difference in probability is of 73 p.p. (= 79 - 6) somehow larger than that of the first stage. While Figure 6 looks at claims over the whole course of June till October 2020, Figure 8 zooms on the first week of June and subsequent weeks. Moreover, there might be a composition effect due to restrictions on the matched sample (i) the sample is restricted to establishments claiming STW in the last week of April and in all the weeks of May (ii) the matching procedure imposes exact matching on location and size category. This likely affects the composition of establishments in both groups and therefore the probabilities.

β_{IV}, from specification (2) are reported for Panel C and D. [26] They correspond to the effect of an increase of the cost of the program on respectively the number of workers and hours furloughed. An increase in the proportional contribution to the program from 0 to 10% of workers' gross hourly wage reduces the number of workers (resp. hours) furloughed by $e^{-.231} - 1 = 21\%$ (resp. 33%).

4 Conclusion

In response to the COVID-19 pandemic, policy makers have aggressively extended their policy toolkit to address the economic challenges posed by the crisis. By changing economic incentives, these policy interventions are likely to affect agents' behavior. This paper focuses on the extension of short-time work (STW) — the main policy instrument to mitigate the labor market consequences of the shock in Europe. This paper studies the context of France, where the program was pre-existing but had historically low take-up, and was massively adjusted ad hoc in response to the pandemic.

Using exhaustive administrative records on STW claims matched with detailed data on employment and establishments, this paper uses quasi-experimental variations in the cost of the program to study firm behavioral responses of two sorts (i) misreporting and (ii) real economic responses. Employers were given significant flexibility in reporting upon claiming STW, leaving room for manipulation.

I first leverage a discontinuity in the cost of the program across workers. I find that employers misreport their workers' gross hourly wage and bunch where government contribution is maximal and their contribution minimal. Counterfactual information on earnings from administrative records allows to rule out real adjustment of earnings in 2020 and attribute the bunching to a reporting margin only. Information at the worker level allows to characterize the reporting behavior of firms. Bunching is not local — workers reported at the kink come from a large segment above the kink — suggesting that the cost of evasion is not sensitive to the size of evasion.

Second, I leverage the introduction of some proportional employer contribution in non-protected industries but not in protected industries to estimate (i) reporting responses and (ii) real economic responses. Upon claiming STW, employers self-report the generosity regime they are eligible to. Comparing eligibility to treatment status, I find that employers in non-protected industries select into a more generous program than they are eligible to.

I then turn to the estimation of real behavioral responses. I use an event study approach and an instrumental variable approach to estimate the demand response to an increase in

[26] The IV estimate for Panel B is not available as the claiming status is unobserved for firms not claiming STW beyond the policy change.

cost of the program. I estimate a 21% decrease in the demand for the program in terms of workers furloughed following an increase in employer contribution from 0 to 10% of worker gross hourly wage.

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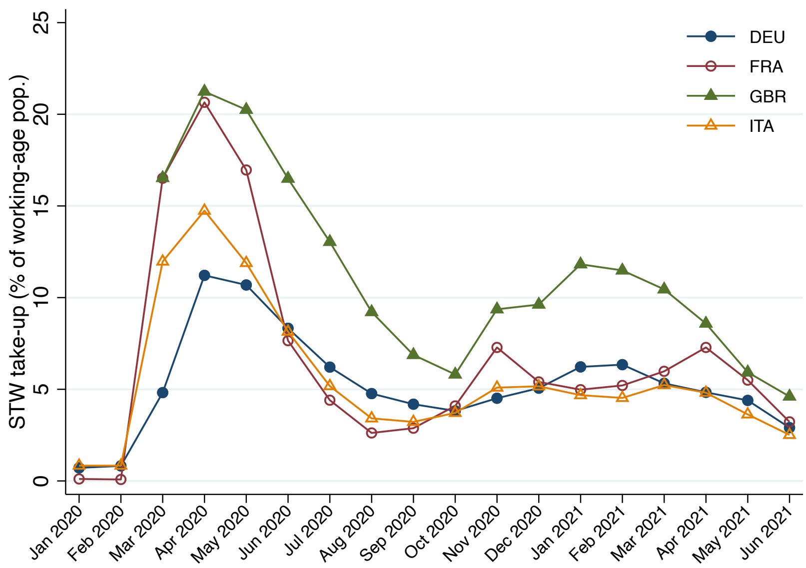
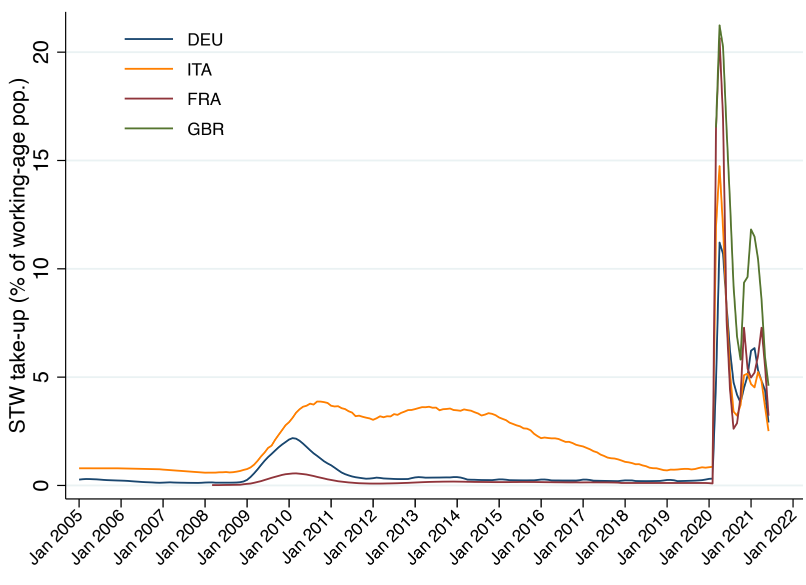
5 Figures

Figure 1: Short-Time Work Usage in Europe

A. Short-Time Work Take-Up During the Pandemic

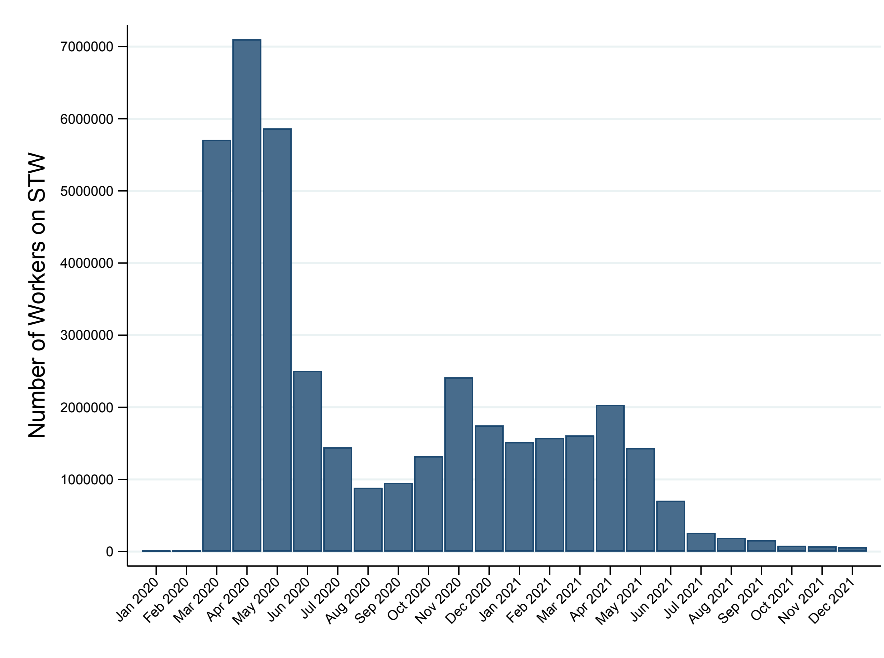


B. Short-Time Work Take-Up between 2005 and 2021



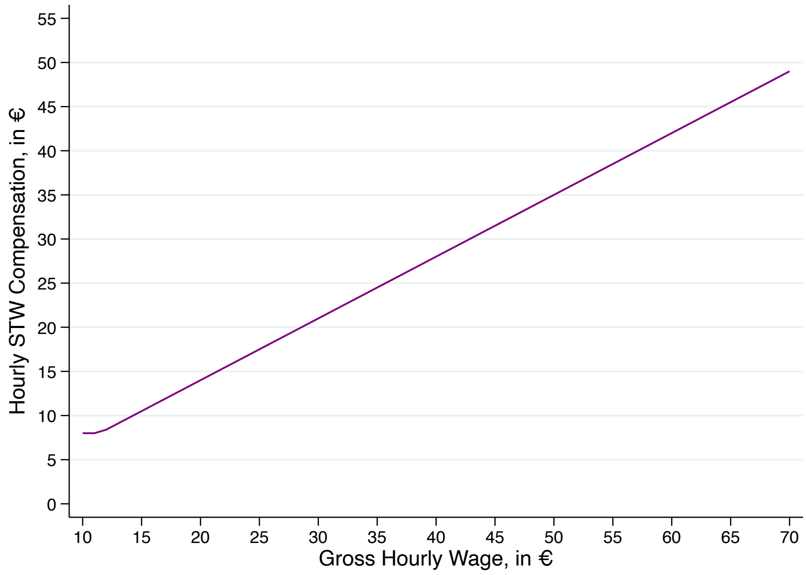
Notes: These figures report the evolution of STW take-up in European countries. STW take-up is computed as the ratio of the number of individuals in the program in a given month, as a percent of the quarterly age population. Panel A covers the pandemic while Panel B looks at STW utilization between 2005 and 2021. The plotted series are moving averages of the raw series. The moving average is based on twelve lagged terms, one forward term and uniform weights. Data on employment comes from OECD. Data on STW and UI take-up comes from the OECD and national statistics.

Figure 2: Number of Workers Furloughed over Time



Notes: This figure shows monthly short-time work utilization at the worker level. Sample is restricted to the main short-time work scheme — *activité partielle classique*. Sample is restricted to workers aged 20-65 in Metropolitan France and excludes trainees and subsidized jobs. Short-time work usage corresponds to validated claims and for which a compensation has been made in month m. The number of workers corresponds to the number of workers with at least one hour furloughed in the month of interest. Figure A1 reproduces this graph using as outcome the number of firms taking-up the program and the number of hours compensated.

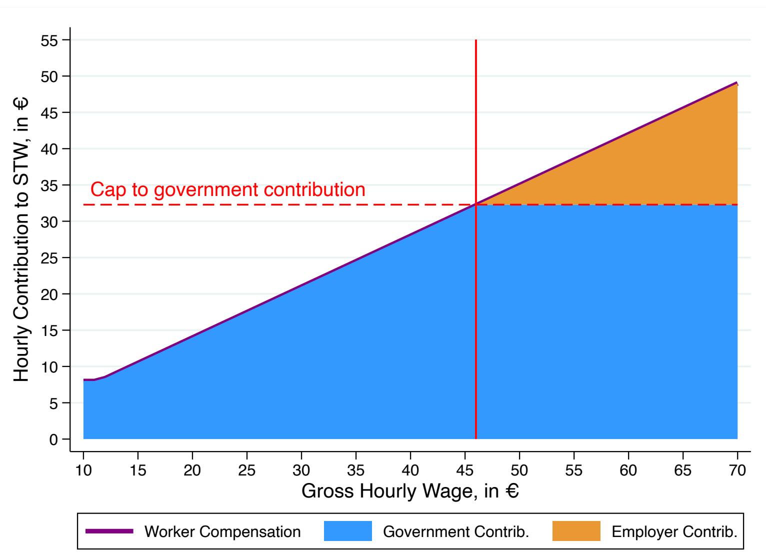
Figure 3: Worker Hourly Short-Time Work Compensation as a Function of Gross Hourly Wage



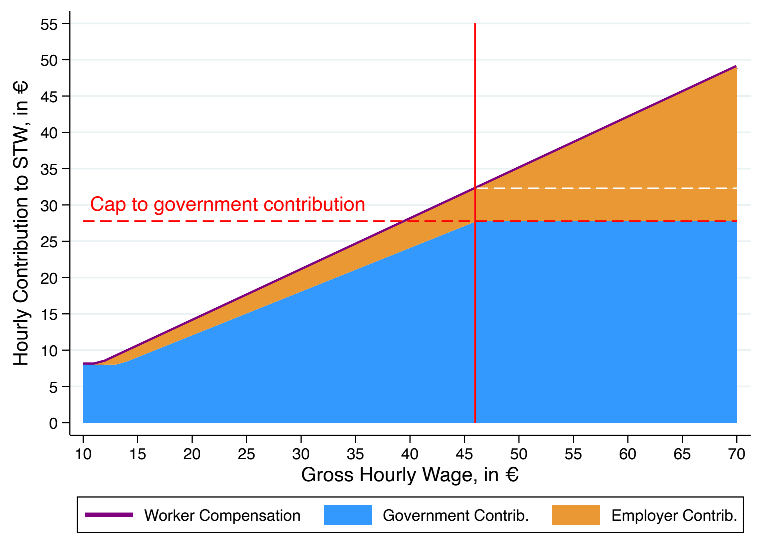
Notes: This figure illustrates how short-time work compensation is defined at the worker level in 2020. Hourly short-time work compensation (y-axis) is a function of worker gross hourly wage (x-axis). For each hour furloughed, the worker receives a compensation of 70% of her gross hourly wage. This roughly corresponds to 84% of net hourly wage. There is a floor at the minimum wage — hourly STW compensation cannot go below 8,03 € per hour. There is no cap to worker compensation.

Figure 4: Government and Employer Contribution to Short-Time Work in 2020, by Worker Gross Hourly Wage

A. No Proportional Contribution Below the Cap

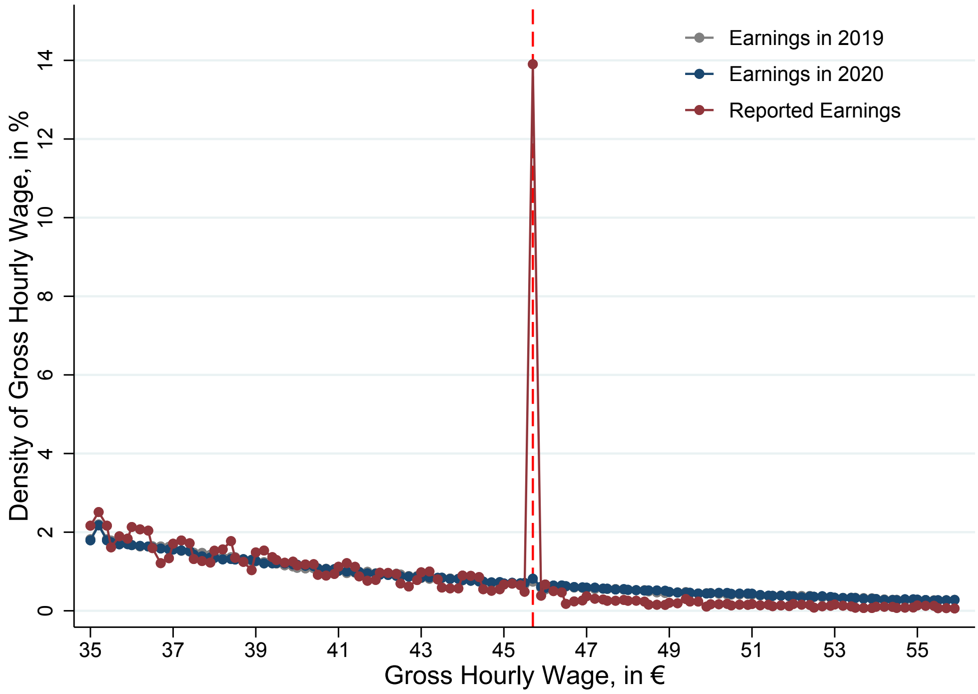


B. Some (10%) Proportional Contribution Below the Cap



Notes: This figure plots government (in blue) and employer (in orange) contribution to hourly STW compensation (y-axis) as a function of worker's gross hourly wage (x-axis). Worker hourly compensation corresponds to the sum of the two (in purple). Both panels correspond to STW compensation as per 2020. Panel A illustrates the schedule to which all firms where subject during the first lockdown and up to June 2020 and some firms beyond June 2020. Panel B illustrates the schedule some firms, in specific industries, were subject to from June 2020. In both schedules, there is a discontinuity in employer contribution at 4.5 minimum wage (45.7€) — marked by the vertical red line. In Panel A, to the left of the red line, the government bears the entire cost of STW and compensates the worker 70% of her gross hourly wage. Beyond the red line, government contribution is capped at 32€ (= .7 $\times$ 45.7€) — marked by the red dashed line. The employer takes over and bears all additional STW compensation. For every additional 1€ of gross hourly wage, the employer pays .70€ of STW compensation to the worker. In Panel B, the same discontinuity applies. The only difference is that below the cap the employer was already contributing to STW by 10% of worker gross hourly wage. The white dashed line marks employer proportional contribution.

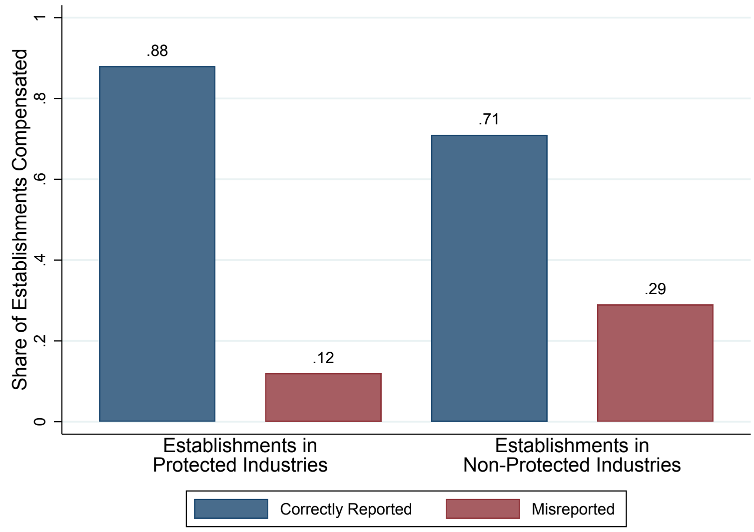
Figure 5: Densities of Gross Hourly Wage Measures in Employment and Short-Time Work Claims Data, Among Short-Time Work Takers



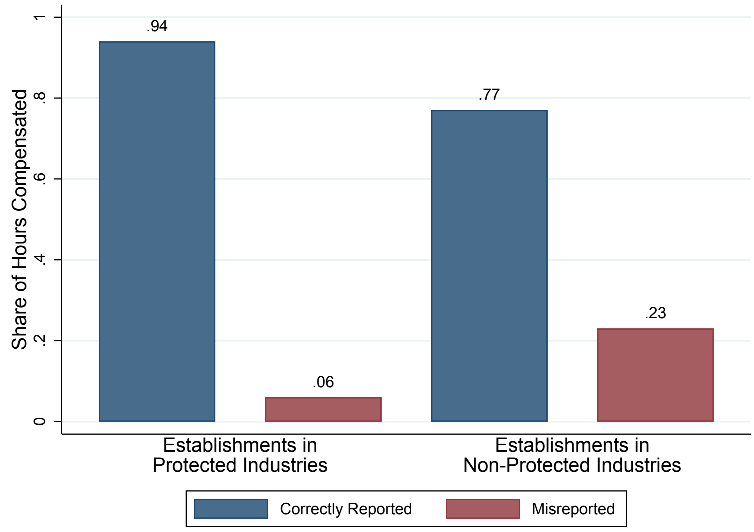
Notes: This figure displays the densities of gross hourly wage measure using bins of .1€ / hour. The blue (resp. gray) curve corresponds to gross hourly wage in 2020 (resp. 2019). Both measures are defined as the ratio of gross earnings on number of hours worked and are derived from employment data. The red curve corresponds to reported gross hourly wage in short-time work claims data. The sample is held constant across the two data sources by using short-time work takers only — i.e. workers with at least 10 hour of furlough in 2020. The red dashed line marks the discontinuity in government contribution. Beyond this line, government contribution is capped and employers cover all additional short-time work compensation. For every additional 1€ of gross hourly wage, employers pay .70€ of short-time work compensation to the worker. The sample is restricted to observations for which there is an exact matching in terms of total hours furloughed in 2020. While the densities for hourly wage in 2019 and 2020 are almost indistinguishable, the density of reported gross hourly wage exhibits a large spike at the discontinuity in employer contribution. This is indicative of bunching as a response to changes in incentives.

Figure 6: Share of Firms and Hours Compensated Under Each Generosity Regime, by Assignment

A. Number of Firms

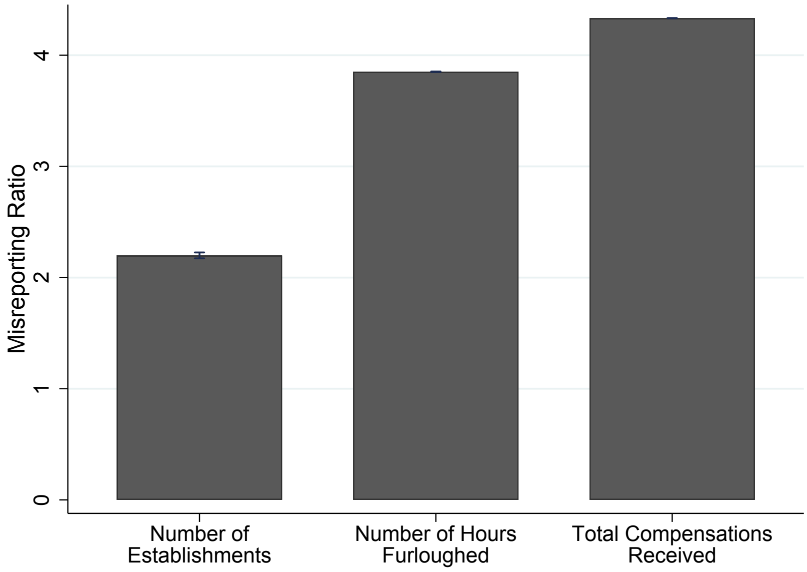


B. Number of Hours



Notes: These Figures compare the reporting errors of establishments in protected industries to that of establishments in non-protected industries. Employers in protected industries do not have to contribute to STW compensation below the cap while establishments in non-protected industries have to contribute by 10% of their worker's gross hourly wage. The first (resp. last) two columns illustrate the reporting behavior of employers in protected (resp. non-protected) industries. Blue columns correspond to compensations in the assigned regime while red columns correspond to compensations in the other regime. The protected status is reported by establishments upon claiming STW — hence the distinction between correctly reported and misreported. Column 2 corresponds to errors of establishments in protected industries — claims under a less generous regime than assigned to. If errors were random, they should be symmetric across protected status and be equal across columns 2 and 4. However, this is not the case. Establishments in non-protected industries claim more often in the incorrect regime — which is more generous — than do establishments in protected industries. The sample corresponds to STW compensation between June and October 2020. For a similar diagnosis using total compensations (in €) see Figure D6.

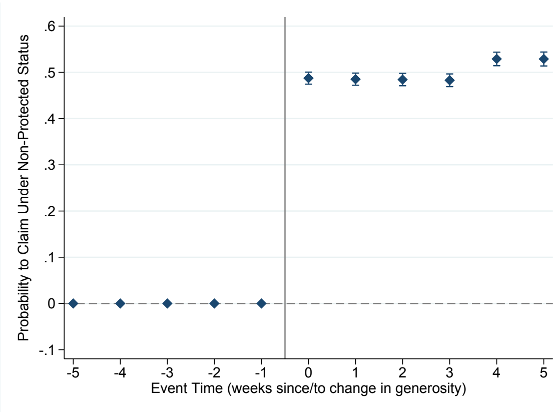
Figure 7: Misreporting Ratio between Non-Protected and Protected Establishments



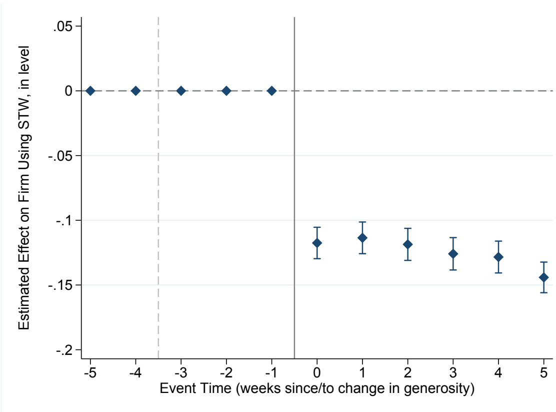
Notes: This figure computes misreporting ratios defined as the share of misreported outcomes among non-protected establishments over that of protected establishments. If errors were random on both sides — among establishments in protected and non-protected industries — then these ratio would be equal to one. Column 1 corresponds to misreporting in terms of the number of establishments claiming. There are twice as many establishments that misreport into a more generous regime than eligible than establishments that misreport into a less generous regime than eligible. Column 2 corresponds to misreporting in terms of hours furloughed. This corresponds to the ratio of column 4 to column 2 in Figure 6. Column 3 corresponds to the amounts of transfers involved in the misreporting. There are around 4 times more hours and amounts misreported from establishments in non-protected industries than in establishments in protected industries. The sample corresponds to short-time work compensation between June and October 2020.

Figure 8: STW Take-Up Response to an Increase in Employer Contribution

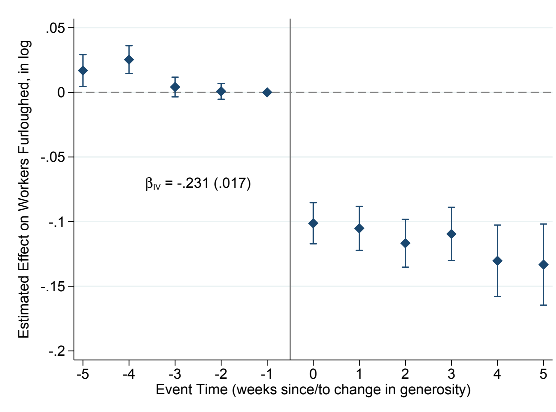
A. First Stage



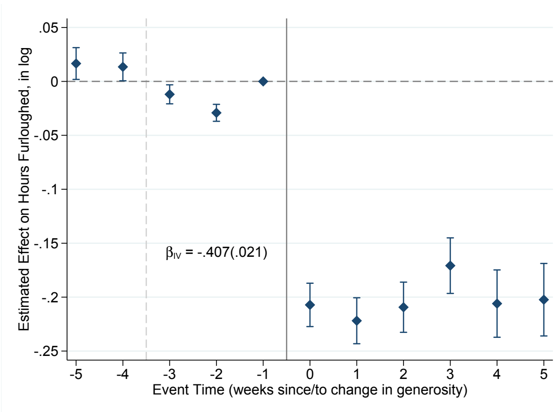
B. Number of Firms



C. Log Number of Workers



D. Log Number of Hours



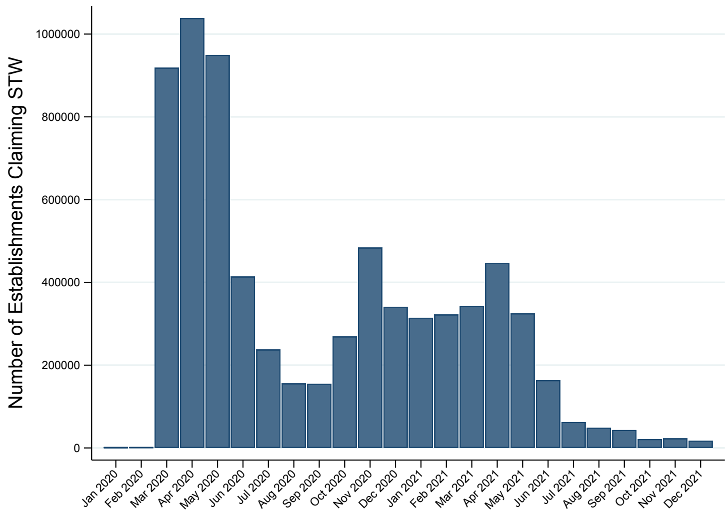
Notes: This figure provides a graphical representation of the variation used to identify the causal effect of the change in the cost of the program labor demand. It plots coefficients β_j for all weeks from a regression following specification (1). Panel A uses as an outcome the probability to claim under the non-protected regime, which is the regime affected by the increase in the cost of the program. This is the difference in probability to face the increase in cost of the program between establishments in non-protected industries (assigned to the treatment) and establishments in protected industries (not assigned to the treatment). Panel B, C, and D use as an outcome short-time work take-up at respectively in terms of establishments claiming, of log number of workers furloughed, and log number of hours furloughed. The last three panels allow to characterize the demand response, in terms of STW take-up, of establishments to the change in cost of the program. Panel C and D report the estimated IV coefficient β_{IV} of the effect of an increase of the cost of the program following the IV model in specification (2).

A Short-Time Work Take-Up in France

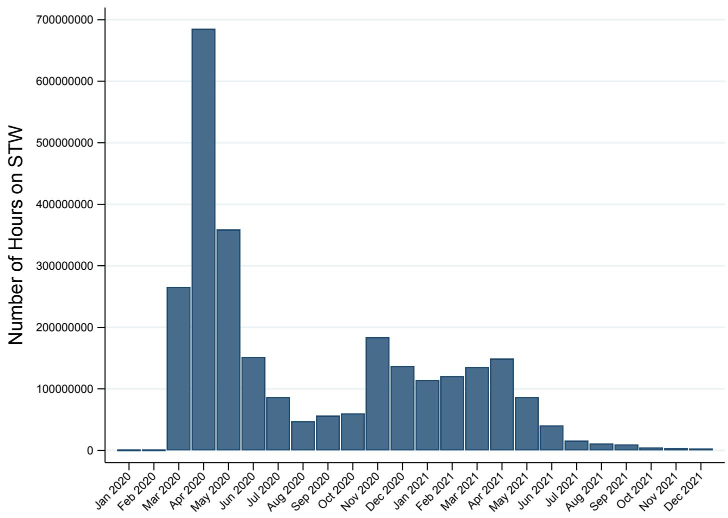
A.1 Short-Time Work Take-Up over Time

Figure A1: Short-Time Work Take-Up over Time

A. Number of Firms



B. Number of Hours



Notes: This Figure shows monthly short-time work utilization at the establishment (Panel A) and hours (Panel B) level. Sample is restricted to the main short-time work scheme. Sample is restricted to workers aged 20-65 in Metropolitan France and excludes trainees and subsidized jobs. Short-time work usage corresponds to validated claims and for which a compensation has been made in month m. A firm is considered a short-time work taker if it furloughs at least one worker in month m. Figure 2 reproduces this graph using as an outcome the number of workers furloughed.

A.2 Different Short-Time Work Programs

A.2.1 Description of the Programs

Standard Short-Time Work The main program is called *Activité Partielle Classique* (AP) — "standard" short-time work. It is the most commonly used program during the pandemic and this for a few reasons. First, at the onset of the pandemic, this was the only program in place. Second, it is very flexible. It comes with no employment preservation condition and is not subject to any employee consultation. Employers can reduce hours worked all the way to 0.

Long Term Short-Time Work In July 2020, an alternative short-time work scheme was re-instated called *Activité Partielle de Longue Durée* (APLD) — long term short-time work. The goal was to progressively substitute this scheme to the main scheme and was targeted at establishments facing a durable reduction of activity. Take-up of the program is conditional on the existence of a collective agreement — at the industry, company, firm, or establishment level. There is no additional eligibility restriction. Upon using the program, employers commit not to layoff workers covered by the agreement.[27] Contrary to the main scheme, reduction in hours is capped at 40% of hours worked (resp. 50 in some specific cases). As in the main scheme, the worker gets an hourly compensation equivalent to 70% of her gross hourly wage. However, proportional government contribution was initially less generous the in the main scheme (at 60% of worker gross hourly wage). [28] The cap to government contribution remains the same. APLD can be leveraged for a maximum duration of 24 months (over 3 years) 6 months at a time. In practice, employers can take-up both programs at the same time and choose which worker to allocate to which program.

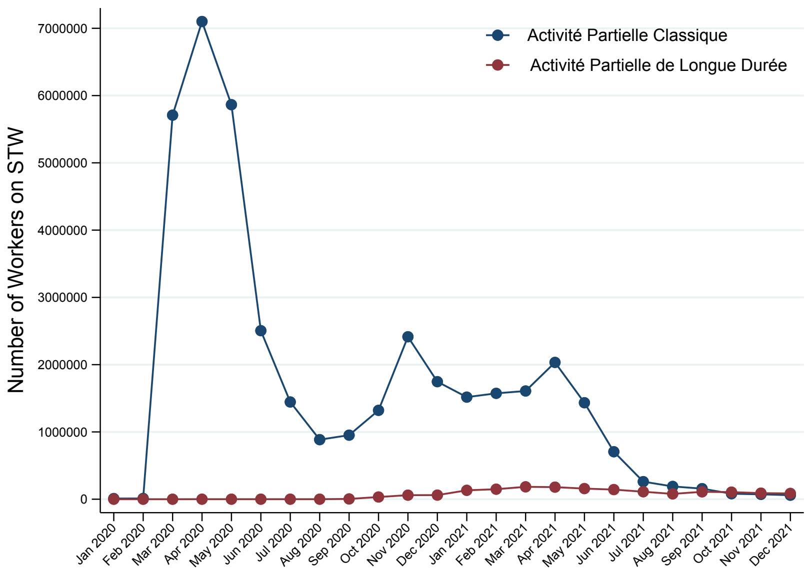
A.2.2 Empirical Evidence on Take-Up of the Programs

Figure A2 offers a visual representation of the relative magnitude of those two programs. It shows monthly short-time work utilization at the worker level for workers compensated under the main scheme — *activité partielle classique* — and under the long term scheme — *activité partielle de longue durée*. Take-up of the long-term program was initially low despite extensive communication by the government and remained essentially flat until the summer of 2021 due to poor calibration.

[27]Else, they have to repay all compensation received. However, firms can lay off workers not covered by the agreement.

[28]At the time, the prevailing government contribution to the main scheme was 70% (resp. 60%) of workers gross hourly wage for establishments in protected (resp. non-protected) industries.

Figure A2: Short-Time Work Take-Up by Type of Program



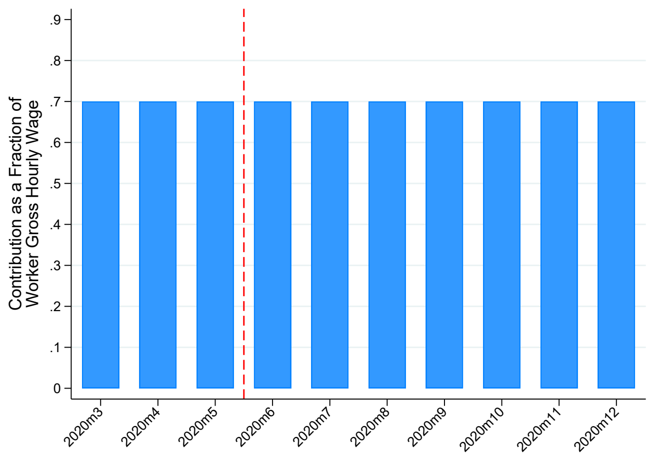
Notes: This Figure shows monthly short-time work utilization at the worker level. Blue dots correspond to workers compensated under the main scheme — *activité partielle classique* — while red dots correspond to workers compensated under the long term scheme — *activité partielle de longue durée*. Short-time work usage corresponds to validated claims and for which a compensation has been made in month m. The number of workers correspond to the number of workers with at least one hour furloughed in the month of interest. The long term scheme was introduced in July 2020 but take-up remained essentially flat until the summer of 2021 due to poor calibration.

B Policy Design

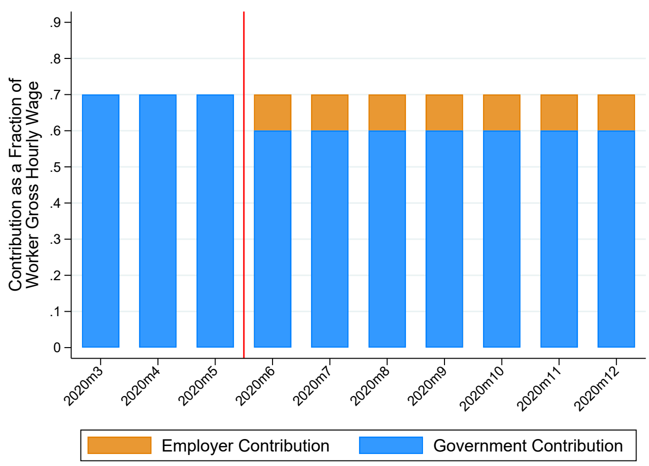
B.1 Schedule for Proportional Employer Contribution

Figure B3: Theoretical Employer Proportional Contribution to STW Over Time, by Protected Status

A. Protected Industries



B. Non-Protected Industries



Notes: This Figure shows the schedule of proportional employer contribution to the program for establishments in protected industries (Panel A) and in non-protected industries (Panel B) in 2020. For each month, it shows the decomposition of employer (in orange) and government (in blue) contribution to worker hourly compensation as a fraction of her gross hourly wage below the cap. From March till May 2020, there is no proportional employer contribution to the scheme. On June 2020, some proportional employer contribution is introduced in non-protected sectors by 10% of worker's gross hourly wage. There exists a third regime which corresponds to establishments subject to administrative closure. The schedule of the latter is not represented as it is excluded from all the empirical exercises.

C Discontinuity in Cost Across Workers

C.1 Data and Sample

C.1.1 Data

Gross Hourly Wage Exhaustive employer-employee data is used to retrieve a measure of gross hourly wage both in 2019 and in 2020. Gross hourly wage is defined as the ratio of gross earnings over the total number of hours worked over the year.

In the employer-employee data, the measure of gross earnings comprises elements of remuneration — baseline salary, payment of overtime hours, and bonuses — as well as in kind benefits, severance payments, employer contribution to professional expenses (mainly transportation and food), and other elements of remuneration.

According to government guidelines, when claiming STW, the employer should report the hourly gross remuneration that the worker would have received excluding non-contractual overtime and specific bonuses.[29] To get as close as possible to this value (i) I restrict the sample to workers continuously employed between 2019 and 2020 — to avoid severance payments — and with at most 1820 hours of work per year — to avoid payment of overtime hours (ii) I subtract from gross earnings the purchasing power bonus — *prime exceptionnelle de pouvoir d'achat*. There remain some elements of compensation that should be excluded from the reported hourly earnings for which information is not available. As a consequence, the resulting measure of observed gross hourly earnings is potentially marginally inflated.

Importantly, in 2020, gross earnings do not include short-time work compensation — as they are not earnings *per se* but transfers — which allows me to distinguish earnings from STW compensation.

Reported Hourly Wage STW compensation records contain direct information on the value of gross hourly wage reported by employers upon claiming STW. I use a matching technique to match workers across STW compensation records — where gross hourly wage is reported — and employment data — where gross hourly wage is observed. I have information on the establishment identifier in both data sets, as such, the matching is only required to identify workers within firms. I use exact matching on gender and place of birth (*département*) and distance matching on age and total hours furloughed in 2020. The final matched sample is further restricted to workers for which total hours furloughed is within a 1 unit deviation across sources. Using information from STW compensation

[29] Bonuses excluded from the computation of hourly STW compensation are: bonuses or contributions to professional expenses, profit-sharing bonuses, bonuses not affected by furlough status, purchasing power bonus

records has many advantages. First, this is exactly what was reported by employers upon claiming. Second, information is available at the monthly frequency. This is key to study the dynamics of reporting behavior over the year and as the schedule changes. Indeed, one can study whether changes in incentives at the cap — depending on the level of proportional employer contribution below the cap — affect reporting behavior.

Some robustness exercises rely on a second measure of reported gross hourly wage derived from the employer-employee data. As mentioned earlier, in 2020, the employer-employer data contain information on total STW compensation and on total hours furloughed. I retrieve a measure of average hourly STW compensation by dividing total compensation by the number of hours furloughed. In order to recover the reported wage used to determine this hourly compensation, I simply divide the measure of hourly compensation by the replacement rate (70%). This measure corresponds to the average reported gross hourly wage (weighted by the number of hours claimed). This measure has the advantage of incorporating both observed and reported earnings in one place. However, the measure of reported earnings is potentially a bit more noisy. Moreover, information is aggregated at the yearly frequency which excludes any dynamic analysis.

C.1.2 Sample

Sample restrictions The sample corresponds to workers aged between 20 and 65 years old in Metropolitan France with continuous employment spells in 2019 and 2020. The sample is restricted to on workers with gross hourly wage between 10 and 80€ in 2020 and with a wage growth of no more than a 20% variation between 2019 and 2020. The sample corresponds to workers who were furloughed for at least 20 hours in 2020 — to avoid a noisy estimate of hourly STW compensation. I restrict the sample to workers with at least 1420 hours worked per year (by a proportional amount for 2020) — corresponding to the minimum workweek requirement. Trainees, apprentices, and any other subsidized employment contract are excluded from the sample as they are subject to a specific compensation schedule.

C.2 Conceptual Framework with No Reporting

This sub-section illustrates how the kinked schedule in employer contribution to STW theoretically affects the firm relative demand for work across two type of workers depending on their relative position with respect to the kink — one above and one below. Initially, it abstracts from any reporting margin but will be incorporated in the subsequent sub-section.

Let us consider a toy model with two workers: the low type (indexed by L) with an hourly wage $\omega_L < \bar{\omega}$ and the high type (indexed by H) with an hourly wage $\omega_H > \bar{\omega}$, with $\bar{\omega}$ the hourly wage at the kink. Workers are complementary in the production of a single good. Our conceptual framework illustrates how initial labor demand (pre-pandemic) adjusts to a shock in a setting with linear vs kinked STW schedule.

C.2.1 Model

Let us first consider the pre-pandemic equilibrium, that is the equilibrium labor demand in steady state. Then, we will illustrate how the employer adjusts its labor demand when facing a shock to its demand when faced with a linear STW schedule — *i.e.* with no discontinuity in cost depending on worker hourly compensation. Lastly, we will study how the kinked schedule theoretically distorts the employer's labor demand across workers.

Pre-pandemic Equilibrium In order to determine the initial labor demand, let us consider a simple program where the employer minimizes its cost subject to a production constraint. I consider labor as the only input in the production function but introduce two types of workers who differ in labor productivity. I refer to the first type of worker as the high type, indexed by H, and the other type as the low type, indexed by L. Workers enter the production function in respective quantities l_L and l_H and are complementary in the production process. To each worker is associated an equilibrium wage ω_i.

In this exercise, I am interested in the effect of a discontinuity in employer contribution to STW depending on the worker hourly wage. For that reason, I consider that the low type has an hourly wage (ω_L) below the cap ($\bar{\omega}$) and the high type has hourly earnings (ω_H) above the cap: $\omega_L < \bar{\omega} < \omega_H$. The program writes as follows:

$$
\begin{aligned}
Min_{l_L,l_H} \quad \omega_L l_L + \omega_H l_H \qquad \text{subject to} \qquad & F(l_H, l_L) \geq \bar{y} \\
& l_L \geq 0 \\
& l_H \geq 0
\end{aligned}
$$

The employer minimizes its labour costs to meet the production constraint subject to a positive (or null) demand for the two types of workers. Assuming an interior solution — i.e. that the bundle of workers makes sense — the first order conditions yield:

$$\frac{w_L}{w_L} = \frac{F'_{l_H}(l_L^*, l_H^*)}{F'_{l_L}(l_L^*, l_H^*)}$$
$$F(l_L^*, l_H^*) = \bar{y}$$

This is the standard equilibrium where the marginal cost equals the marginal rate of transformation. The level of demand ($\bar{y}$) determines the optimal labor demand: l_L^*, l_H^* where l_i^* corresponds to the total labor demand for type i which can be thought of equivalently in terms of hours or number of workers.

Pandemic Equilibrium under Linear Schedule Let us now consider the impact of a shock to the demand ($\tilde{y} < \bar{y}$) on firm labor demand. Let us first consider a linear STW schedule where the marginal cost of the program does not differ according to the worker hourly wage. For simplicity, I illustrate the framework with no proportional employer contribution ($\rho = 0$) although it can be easily incorporated.[30]

$$\begin{aligned} Min_{l_L, l_H} \quad \omega_L l_L + \omega_H l_H \qquad \text{subject to} \qquad & F(l_H, l_L) \geq \tilde{y} \\ & \bar{y} > \tilde{y} \\ & l_L^* \geq l_L \geq 0 \\ & l_H^* \geq l_H \geq 0 \end{aligned}$$

Here the employer determines the optimal labor demand (l_i) given the initial labor demand (l_i^*) and the new production level. The trade-off remains the same as the STW schedule affects proportionally the marginal cost of labor for the high or low type. What differs is the level of production reached, this will determine the level of labor demand.

[30]Under the linear schedule and proportional employer contribution, each hour worked costs ω_i and each hour furloughed costs $\rho * \tau * \omega_i$. For each additional hour of work, the employer compensates the worker by her hourly wage but implicitly saves on an hour of furlough which marginal cost is $\rho * \tau * \omega_i$. So the marginal cost of an hour of work is (1-$\rho * \tau$) $* \omega_i$. The relative marginal cost writes $(1 - \rho * \tau) * \omega_H / (1 - \rho * \tau) * \omega_L$ which simplifies to ω_H / ω_L. The trade-off is similar to that of the core of the text. The only difference is total cost for the employer which might affect the separation margin or decision to produce.

$$\frac{\omega_H}{\omega_L} = \frac{F'_{l_H}(l_L, l_H)}{F'_{l_L}(l_L, l_H)}$$
$$F(l_L, l_H) = \tilde{y}$$

Assuming an interior solution, a negative shock, and an adjustment on the two workers, the new equilibrium is such that the labor demand allows to produce a lower quantity of output ($\tilde{y} < \bar{y}$). Both workers face a proportional reduction in hours worked.

Pandemic Equilibrium under Kinked Schedule Let us now consider the distorsion introduced by a kink in employer contribution to STW — as per French context in 2020. Under this design, the relative cost of an hour of work — or equivalently the opportunity cost of an hour of furlough — varies depending on the worker gross hourly wage. In turn, this distorts the relative marginal cost between the two workers.

$$Min_{l_L,l_H} \quad \omega_L l_L + \omega_H l_H + \tau \times (\omega_H - \bar{\omega}) \times (l_H^* - l_H) \qquad \text{subject to} \qquad \begin{aligned} &F(l_H, l_L) \geq \tilde{y} \\ &\bar{y} > \tilde{y} \\ &l_L^* \geq l_L \geq 0 \\ &l_H^* \geq l_H \geq 0 \end{aligned}$$

Assuming an interior solution, the first order conditions simplify to:

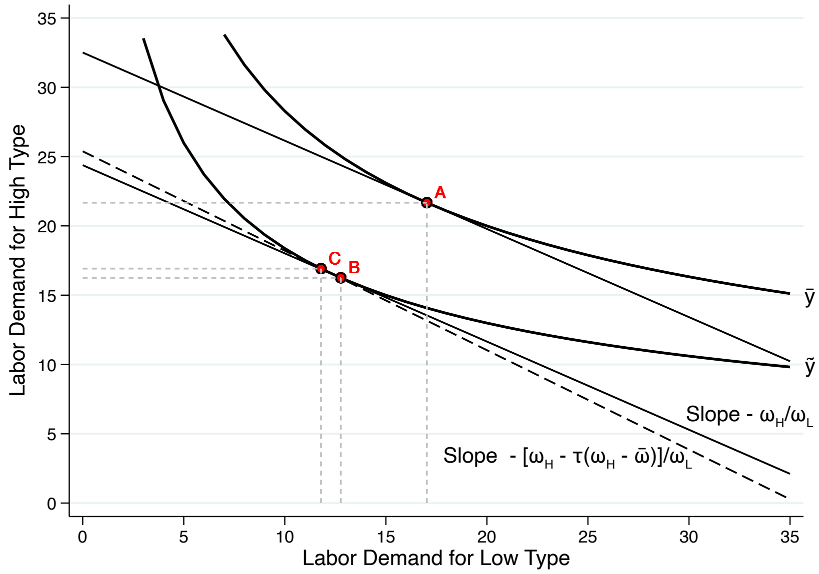
$$\frac{\omega_H - \tau \times (\omega_H - \bar{\omega})}{\omega_L} = \frac{F'_{l_H}(l_L, l_H)}{F'_{l_L}(l_L, l_H)}$$
$$F(l_L, l_H) = \tilde{y}$$

Compared to the equilibrium under the linear schedule, the relative cost of an hour of work for the high type worker is reduced. This induces a shift for relatively more demand for high type labor and less relative demand for low type labor. The overall total cost of production is higher. The kinked schedule reduced the marginal cost of labor of the high type through the marginal cost of an hour of furlough. This is equivalent to a subsidy on work of the high type.[31] Importantly, the magnitude of the substitution across workers depend on their hourly wage (ω_L and ω_H), on the magnitude of the shock ($\Delta = \tilde{y} - \bar{y}$), and on the substitutability across workers (α in the case of a CES production function).

[31] Similarly to before, one can incorporate proportional contribution to the kinked schedule. The relative marginal cost writes $[(1-\tau) * \omega_H + \tau * (1-\rho) * \bar{\omega}]/(1-\rho*\tau) * \omega_L$.

C.2.2 Graphical Illustration

Figure C4: Theoretical Adjustment of Labor Demand to a Shock under Linear and Kinked STW Schedule



Notes: This Figure describes the initial equilibrium (A) and the equilibria post-shock under both a linear (B) and a kinked (C) schedule. The x-axis (resp. y-axis) corresponds to the labor demand for the low (resp. high) type worker. Equilibria correspond to tangency points between isoquants and iso-cost curves. Each type of worker is characterized by its initial (contractual) labor demand (A). Each type of worker experiences a reduction in hours worked and is furloughed for the remaining hours. Going from the linear to the kinked schedule tilts the iso-cost curve. The slope of the isocost curve goes from $-\omega_H/\omega_L$ to $-(1-\rho*\tau)*\omega_H/\omega_L$. This induces a substitution of hours worked by the low type for hours worked by the high type as illustrated by the shift of the equilibrium from B to C. The production function is a Cob-Douglas with parameter $\alpha = 2/3$ and the initial production level is set at 20 units and the demand shock is of -5 units. The hourly wage of the low type is set at 35€ and at 55€ for the high-type. Note that the kink in the STW schedule is at 45.7€. Note that the magnitude of the substitution effect depends on all the above parameters.

C.3 Conceptual Framework with Reporting

In reality, the claiming process relies on employer reporting information on their characteristics as well as on their employees. For each worker furloughed, employers report worker's gross hourly wage and the number of hours worked in the period of interest. This then determines the level of worker compensation as well as the level of employer contribution to the scheme.

C.3.1 Model

In order to better match the claiming process, one should incorporate as a choice variable the gross hourly wage reported to the public administration upon claiming STW — denoted $\hat{\omega}_i$. Note that the worker still earns ω per hour worked but the employer reports $\hat{\omega}$. There is a cost C(.) to misreporting — i.e. reporting $\hat{\omega} \neq \omega$ — on which I remain agnostic for now. For each additional euro of gross hourly wage reported above the kink, the employer contributes by τ€ per hour furloughed.

The employer minimization program rewrites:

$$Min_{l_L, l_H, \hat{\omega}_H} \quad \omega_L l_L + \omega_H l_H + \underbrace{\tau \times (\hat{\omega}_H - \bar{\omega}) \times \mathbb{1}(\hat{\omega}_H > \bar{\omega}) \times (l_H^* - l_H)}_{\text{Tax liability, employer contribution to STW}} + \underbrace{C(.) \times \mathbb{1}(\hat{\omega}_H \neq \omega_H)}_{\text{Cost of misreporting}}$$

$$\begin{aligned} \text{subject to} \quad & F(l_H, l_L) \geq \tilde{y} \\ & \bar{y} > \tilde{y} \\ & l_L^* \geq l_L \geq 0 \\ & l_H^* \geq l_H \geq 0 \end{aligned}$$

The first order condition with respect to $\hat{\omega}$ writes:

$$\underbrace{\frac{\delta C(.)}{\delta \hat{\omega} - \omega}}_{\text{Marginal Cost of Misreporting}} - \underbrace{\tau \times \mathbb{1}\{\hat{\omega} \geq \bar{\omega}\} \times (L - l)}_{\text{Marginal Tax Saved on Reported Wages}} = 0$$

Cost of Misreporting Theoretically, the existence of a bunching response in reported outcome depends on the assumptions on the cost of misreporting — C(.). They correspond more specifically to assumptions on how the cost evolves with the size of evasion ($\hat{\omega}_i - \omega_i$), the intensity of short-time work usage ($l_i^* - l_i$), and how the probability of audit and the sanctions evolve as a function of these former two parameters.

The usual assumptions which generate local bunching local bunching response are (i) an increasing and convex cost of misreporting and (ii) an increasing probability of audit and size of fines with the size of the evasion — which comprises both the distance to the true value but also the resulting evaded amount which depends on the worker's replacement rate τ and the number of hours claimed.

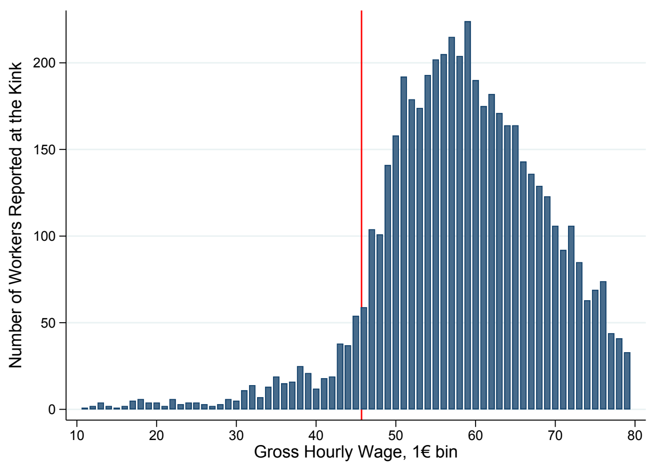
In order to inform some of these assumptions, I leverage the unique feature of my setting which allows me to put into perspective, at the worker level, reported gross hourly wage upon claiming and actual gross hourly wage as per employment data.

C.3.2 Additional Empirical Facts on Reporting Behavior

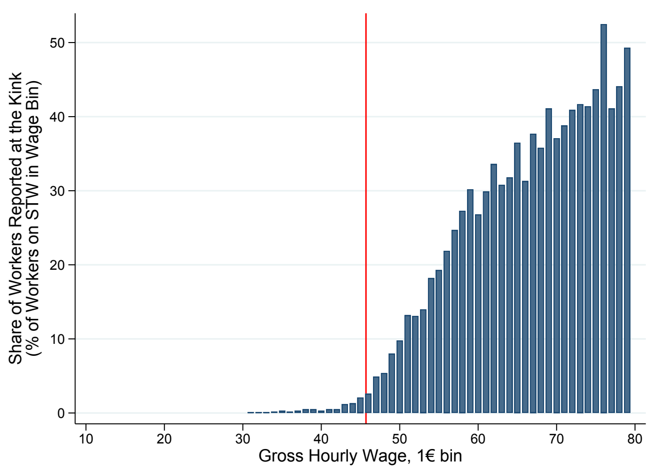
Location of Bunchers and Bunching Intensity Figure C5 provides additional information on the location of bunchers as well as the reporting pattern across wage bins. Panel A plots the number of workers reported at the kink by bins of 1€ of gross hourly wage in 2019. While there are a few workers with earnings below the kink that are reported at the kink, most of them come above the kink. In absolute quantity, the bins with most workers reported at the kinks are between 50 and 65€. Panel B plots the share of workers reported at the kink among all STW takers — i.e. among all workers with a reported hourly wage. The share of workers reported at the kink increases proportionally with the distance to the kink. Interestingly, the same patterns hold when weighing each observation by the number of hours furloughed.

Figure C5: LOCATION OF WORKERS REPORTED AT THE KINK, BY TRUE GROSS HOURLY WAGE

A. NUMBER OF WORKERS REPORTED AT THE KINK



B. SHARE OF WORKERS REPORTED AT THE KINK



Notes: This Figure shows the repartition of workers with hourly wage reported at the kink — bunchers — by origin in the observed wage distribution — *i.e.* by bins of 1€ of actual gross hourly wage in 2019. The sample consists of all individuals from our baseline matched sample. Panel A plots the number of workers reported at the kink while Panel B plots the share of STW takers reported at the kink among all STW takers in the wage bin. The red line corresponds to the kink in employer contribution. Most workers with a reported hourly wage at the kink have an actual wage above the kink. The share of workers reported at the kink among all STW takers increases proportionally with the distance to the kink.

D Behavioral Responses to a Change in Price

D.1 Descriptive Evidence on Protected and Non-Protected Industries

Table D1: Descriptive Evidence of Employer Characteristics in the Main Sample, by Protected and Non-Protected Industry Codes (2019)

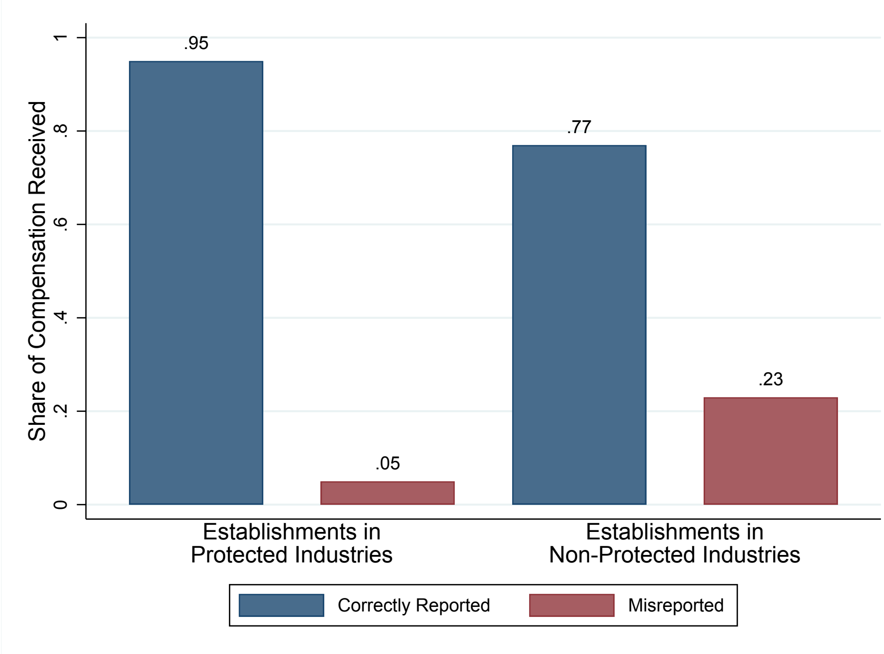
	(1) All Industry Codes		(2) Protected Industry Codes		(3) Non-Protected Industry Codes	
	Mean	(s.d.)	Mean	(s.d.)	Mean	(s.d.)
	I. Establishment Characteristics					
Prop. in manufacturing	.09	.29	.01	.09	.11	.31
Prop. in construction	.14	.35	0	0	.17	.37
Prop. in services	.77	.42	.99	.09	.72	.45
Prop. below 1 year	.14	.35	.20	.40	.13	.33
Prop. below 2-9 years	.30	.46	.36	.48	.29	.45
Prop. over 10 years	.56	.50	.44	.50	.58	.49
	II. Employment					
Employees (headcount)	14	66	9	61	14	67
Employees (FTE)	10	53	6	51	10	53
Prop. on open-ended contract	.89	.22	.85	.27	.89	.21
Prop. on fixed-term contract	.11	.22	.15	.27	.10	.20
Annual hours worked per employee			1,154	476	1,335	450
N	1,269,645		220,374		1,049,271	

Notes: This Table reports the mean and standard deviation of a set of establishment-level variables for firms in our sample as of 2019. The summary statistics refer to year 2019, the year prior to the pandemic. Column 1 refers to all establishments with both protected and non-protected industry codes. Column 2 restricts the sample to establishments in protected industries and column 3 to establishments in non-protected industries. This empirical exercise only considers industries for which the protected status is constant throughout 2020. The sample comprises all establishments in metropolitan France with a tradable activity, in all industries apart from agriculture. Sample is restricted to workers with open ended and fixed term contracts.

D.2 Misreporting of Protected Status

D.2.1 Additional Outcome

Figure D6: Share of Compensation Received (€) Under Each Generosity Regime, by Assignment



Notes: This Figure exhibits reporting errors of establishments in protected and non-protected industries. It uses as an outcome total compensation. The first (resp. last) two columns correspond to reporting behavior of establishments in protected (resp. non-protected) industries. Blue columns correspond to compensation in the assigned protected regime while red columns correspond to compensation in the other regime. Establishments in protected industries do not have to contribute to short-time work compensation below the cap while establishments in non-protected industries have to contribute by 10% of worker gross hourly wage. Column 2 corresponds to compensation received by protected establishments under a less generous regime than assigned. Establishments in non-protected industries are compensated relatively more under a more generous regime than assigned to (22%) than establishments in protected industries are under a less generous regime than assigned to (5%). The sample corresponds to short-time work compensation between June and October 2020

D.2.2 Descriptive Table

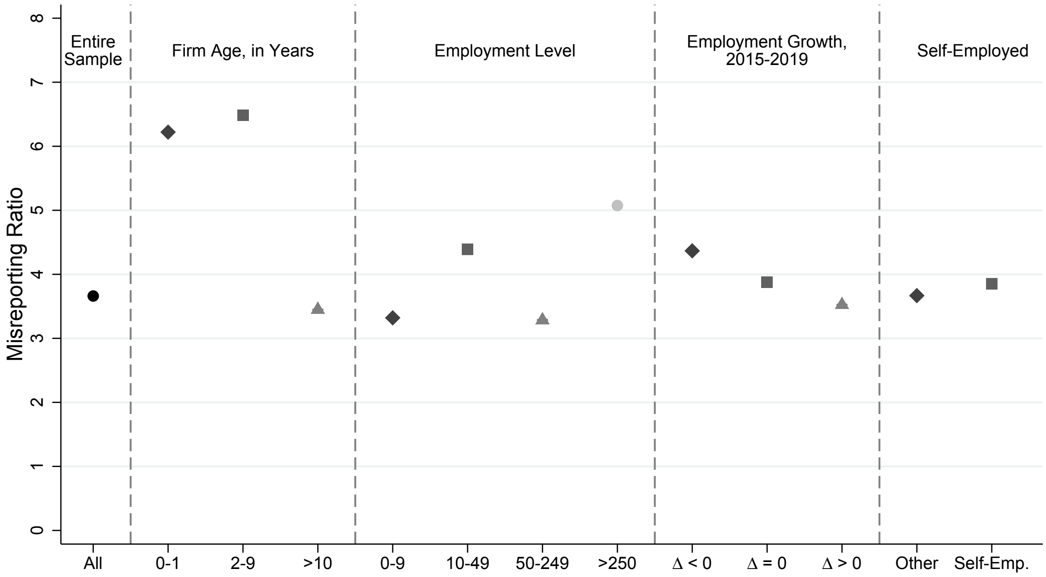
Table D2: Assigned vs Reported Protected Status Among STW Compensation, Between June and October 2020

Assigned Status	Reported Status		Share
	Non-protected	Protected	Misreported
	I. Number of Firms		
Non-Protected	171,507	62,675	27%
Protected	11,875	81,261	13%
	II. Number of Hours Furloughed (k)		
Non-Protected	129,307	347,73	21%
Protected	6,930	113,000	6%
	III. Total Compensation (k €)		
Non-Protected	1,403,560	393,403	22%
Protected	67,800	1,221,731	6%

Notes: This Table covers STW compensation between June and October 2020. During this period, employers in protected sectors do not need to contribute to worker compensation below the threshold while employers in non-protected sectors contribute proportionally to worker compensation by 10% of their gross hourly wage. When claiming short-time work, employers were asked to report their protected status. This table compares assignment to reported protected status. The rows corresponds to the assignment as per the legislation, based on establishments industry code. Column 1 and 2 corresponds to the reported status in STW compensation, that is STW claims that have been approved and for which a transfer has been made. Column 1 corresponds to STW compensation under protected regime while column 2 under non-protected regime. The last column computes the fraction of outcome compensated under the wrong protected regime as a share of total outcome. For establishments assigned to the non-protected (resp. protected) regime, this corresponds to the ratio of the outcome compensated under the protected (resp. non-protected) regime over the sum of the two columns.

D.2.3 Heterogeneity by Establishment Characteristics

Figure D7: Misreporting Ratio of Hours Between Non-Protected and Protected Establishments, by Sub-Samples



Note: Misreporting ratio defined as the share of misreported outcomes among non-protected establishments over that of protected establishments

D.3 Event Study

D.3.1 Weekly Information on STW Take-Up

Table D3: Weekly and Monthly Information on Short-Time Work Take-Up

	Monthly Information	Weekly Information	Share Weekly
	I. All Industries		
Establishments (k)	661	541	.82
Workers (k)	5,464	3,520	.64
Hours (k)	867,929	555,796	.64
	II. Protected Industries		
Establishments (k)	117	98	.84
Workers (k)	881	571	.64
Hours (k)	227,851	145,381	.65
	III. Non-Protected Industries		
Establishments (k)	544	443	.81
Workers (k)	4,583	2,950	.64
Hours (k)	640,078	410,415	.64

Notes: This Table compares the information on short-time work take-up from two variables. Both variables come from worker level data on STW take-up. The first column corresponds to monthly level information STW consumption while the second column corresponds to an aggregation, at the monthly frequency, of weekly level information. Monthly information is exhaustive, while weekly information is not. Information on weekly hours worked and furloughed is not available for every worker due to flexible work arrangements that do not specify a split of hours worked across weeks. Working at the weekly frequency allows to isolate precisely policy changes. This table compares the coverage of the weekly sample to that of the monthly sample. The sample spans from April to July 2020, around the time of the first increase in proportional employer contribution among establishments in non-protected industries. The sample is restricted to establishments in industries whose protected status is constant over the period. The diagnosis is declined for the entire sample (I.) and by protected status of establishments (II. and III.). All outcomes are expressed in thousands. The loss of information is small in terms of number of establishments (18%) and slightly larger in terms of workers and hours furloughed (36%). This holds in similar proportions in both sub-groups.

Table D4: Worker Characteristics in Weekly and Monthly Samples

	Monthly Information		Weekly Information	
	Mean	(s.d.)	Mean	(s.d.)
	I. Worker Characteristics			
Prop. of female	.40	.49	.41	.49
Age	40.98	11.43	40.82	11.57
Occupation				
Executive/Manager	.15	.36	.07	.26
Low qualified white collar	.49	.50	.52	.50
Manual Worker	.36	.48	.41	.49
	II. Short-Time Work Take-Up			
Hours Furloughed	157.22	122.71	157.88	121.38
Compensation (in €)	1,766.41	1,636.53	1,655.95	1,458.25
Hourly Gov. Contribution	11.43	7.91	10.73	8.87
N	5,464,303		3,520,416	

Notes: This Table compares the characteristics of workers furloughed for which information is available at the monthly frequency (columns 1 and 2) to the sub-set of workers for which information is also available at the weekly frequency (columns 3 and 4). For every worker furloughed, information is available at the monthly frequency. For a large set of them, information is also available at the weekly frequency. Working at the weekly frequency allows to isolate precisely policy changes. This table compares the coverage of the weekly sample to that of the monthly sample. Information on worker characteristics come from reported information by employers upon claiming short-time work. The sample spans from April to July 2020, around the time of the first increase in proportional employer contribution among establishments in non-protected industries.